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Report of the Commissioners appointed by the Legislature of the State of New York, by the Act of May 11, 1846, *to locate certain portions of the New York and Erie Railroad, made to the Legislature, January* 14, 1847.

To the Legislature of the State of New York:

The Commissioners appointed by "An Act to amend an Act entitled 'An Act in relation to the construction of the New York and Erie Railroad,' passed May 11th, 1846, and for other purposes," respectfully present the following Report:—

The fifth and sixth sections of the Act direct that the Commissioners shall proceed to adjudge and determine, whether, in their opinion, a practicable interior line or route exists, upon which the Company can construct their railroad, without great prejudice to the public interest of the State, and the interest of the citizens collectively considered, who will be affected by the construction and location of the road.

The seventh section of the Act directs that, in determining the question whether such routes exist, the Commissioners shall take several matters into consideration, among which is a comparison of grades, elevations and depressions, and curvatures, on the line or track of such railroad, in other counties east and west of Sullivan county.

It was urged, on the part of the friends of the interior route, that,

under the Act, the Commissioners had only to determine, as an abstract and independent fact, whether a practicable interior line or route existed upon which a road could be constructed without great prejudice to the public interest, and that, in coming to such determination, the Commissioners were not authorized to compare it with any other line or route, or to survey any other route with a view to such comparison.

If such a narrow construction of the Act were to prevail, it is very apparent that the Commissioners would have nothing to do but to establish the interior routes, as it is quite evident such routes are practicable; that it is possible to construct a railroad thereon, and that such railroad, instituting no comparison with *any other line*, can be constructed without great prejudice to the public interest. But these facts were as clear to the Legislature, who enacted the law, as they are to the Commissioners, who act under it. They were perfectly obvious from the surveys, reports, and estimates before the Legislature; and if the Legislature entertained the views pre-supposed by such construction, they would have simply directed the construction of the road, without any useless reference to Commissioners.

It seemed to the Commissioners further quite evident, that whether the interior lines were practicable, and afforded routes for the construction of a railroad, without great prejudice to the public interest, was not a question of mere abstract practicability and freedom from injury, but was necessarily comparative. The Commissioners could not adjudicate as to the matters which they were required by the Act to adjudicate, without comparing the interior routes with some other routes, and from the comparison make the determination. The Act, in the estimation of the Commissioners, clearly contemplated such comparison, as a preliminary to the adjudication; and it was to them as clear, that the comparison should be made between the interior routes, and the routes through Pennsylvania. The application of the Company for leave to construct a portion of their road in Pennsylvania, which was followed by the law under which the Commissioners acted, and from the provisions of said law, clearly indicated the propriety of making such a comparison of routes.

It is believed that the Commissioners were unanimous in the opinion, that as an abstract question, practicable interior lines did exist upon which a railroad could be constructed; and also, in the opinion that it was proper, in making an adjudication, to compare the interior lines or routes with the Pennsylvania routes, both of which had been caused by the Commissioners to be surveyed, and estimates of cost made. It was found, as the result of such surveys and estimates, that the grades of the interior routes were as favorable as they were supposed to be when the Act was passed, and that the expense of construction of the Pennsylvania route would be about a half a million of dollars more than upon the interior routes.

It is believed that the Commissioners were unanimously of the opinion that the Pennsylvania routes, though constructed at a greater cost, and paying $10,000 annually as a tax to the State of Pennsylvania, considered solely in view of the natural advantages of the two

routes, would yet, from the much more favorable character of the grades, be the preferable route for the Company to adopt, and for the public to employ.

The evident purpose of appointing the Commissioners was, that they should obtain the facts accurately, compare the merits of the two routes candidly, and determine upon the interior routes, unless the merits of the Pennsylvania routes greatly preponderated. If the surveys of the interior routes should prove to be more favorable than the surveys of the same routes previously before the Legislature, it does not therefore follow, necessarily, that the interior routes should now be adopted. If that had been intended as a necessary consequence of such favorable results of the surveys, the Legislature would have so said. If the grades in the counties east and west of Sullivan, are steeper than the grades on the interior routes through Sullivan, it does not therefore necessarily follow, that such interior route should be adopted. The Legislature have not so directed. The more favorable grades shown by the recent surveys, are facts to be taken into consideration by the Commissioners, and to have their due influence; but they are not to outweigh all the other facts of the case.

The important question is, can the road be constructed on the interior routes "without great prejudice to the public interest," and what, within the meaning of this Act, is to be deemed such great prejudice, as, when compared with the advantages of a more favorable location, to forbid the construction on the interior routes. The interests of the citizens, who are to be affected by the location of the railroad, collectively considered, are to be taken into the account in making up the estimate of prejudice to such interests.

The interests of all the citizens living upon the line of the road, or within the vicinity of the line of the road, or whose property will be transported to market by means of the road, or who will be interested in the traffic of the road, will be affected by its location and construction.

Having submitted the preceding remarks, on the duties devolved by the Act, the Commissioners proceed to give a statement of their investigations and conclusions under it.

At a meeting of the Commissioners held on the 26th of May, two engineers were appointed; one to make the surveys and estimates required on the routes between the summit of the Shawangunk ridge and Deposit; and the other for the routes between Deposit and a point one mile westerly of the village of Binghampton. Henry Tracy, Esq., was appointed to the first-mentioned routes, and James O. Morse, Esq., to the last-mentioned routes. Those engineers were both on the surveys under the previous commission; and they were directed to enlarge their parties for more full examination.

Under the views taken by the Commissioners, the engineers were instructed to survey the routes that pass through portions of the State of Pennsylvania, on the Susquehanna and Delaware rivers. On the 22d of June, the Commissioners held a meeting in New York, with the view of making a tour over the districts interested in the questions submitted to them, of obtaining a general knowledge of the

country, of conferring with such of the inhabitants as desired to make suggestions, and also of advising with the engineers as to the progress they had made, and the probable time when they would be able to submit the results of their surveys.

The Commissioners proceeded to Binghampton, and four of their number, Messrs. Childs, Wilson, Pierson, and Dewey, returned by way of Nineveh to Deposit; thence, via the Delaware river to Port Jervis, and arrived at New York on the 3d of July; a meeting was there held by the Commissioners on that day, at which it was decided that a meeting be held at the same place on the 3d of August; whence they would proceed to Monticello, to Harpersville, and Binghampton, to hold sessions at these places respectively, on the 5th, 10th, and 12th of August, in order to hear such parties as might have any matter to submit to their consideration, in relation to their duties under the Act. It was further decided that public notice of the proposed meetings should be made in one of the newspapers in the city of New York, one in each of the counties of Sullivan and Broome, and in the Albany Argus.

On the 3d of August, the Commissioners met in New York, and thence proceeded to the places indicated, and held meetings agreeably to the above-mentioned arrangement.

At each place, the general result of the surveys made by the engineers was made public, and all persons who were disposed had full opportunity to present their views on the subjects submitted to the Commissioners. The several occasions were improved by friends of the different routes, who entered, in their discussions, fully into the reasonings which they respectively regarded as favorable to the routes they advocated.

General Description of the Routes Surveyed under the Direction of the Commissioners.

Commencing at a point about one mile westerly of the village of Binghampton, and extending eastwardly to Deposit, there are two routes; which, for distinction, are called, one, the Nineveh, or interior route, and the other, the Susquehanna, or river route.

The Nineveh route passes up the Chenango valley to Port Crane, near the mouth of Page Brook, where the heavy grade commences, thence follows Page Brook Valley and reaches the summit between the Chenango and Susquehanna rivers, called the new Ohio summit. To reach this summit, a grade of 65 feet to the mile is encountered. The line then descends and reaches the Valley of the Susquehanna at Nineveh. The line then ascends by a maximum grade of 65 feet per mile to the Bettsburgh summit, which is the summit between the Susquehanna at Nineveh and the Delaware at Deposit. The line then descends to Deposit. The total length is 43·58 miles.

The Susquehanna route passes through the village of Binghampton, and continues up the Valley of the Susquehanna to near Lanesboro, in the State of Pennsylvania. To this point the maximum grade is 20 feet to the mile. It then leaves the Valley of the Susquehanna and reaches the Gulf summit, or the summit between the Susquehanna at Lanesboro, and the Delaware at Deposit. The maximum grade,

to reach this summit, is 68 feet per mile. The line then descends to Deposit: the total length is 39·29 miles.

The following tabular statement shows the essential character of the two routes:—

	Susquehanna, or River Route.	Nineveh, or Interior Route.
Maximum grade going east,	68 ft. per mile,	65 ft. per mile.
" " " west,	67 " "	74 " "
Number of summits,	1 summit,	2 summits.
Length of line on which maximum grade rules,	15·66 miles,	35·6 miles.
Total ascent going east,	540 feet,	1087 feet.
" " " west,	395 "	936 "
Total rise and fall,	935 "	2023 "
Minimum radius of curves,	1000 "	1056 "
Total curvature, in degrees,	2371 degrees,	3253 degrees.
Length of lines,	39·29 miles,	43·58 miles.
Total estimated cost of grading, with superstructure on extra length,	$746,900	$628,600

The maximum grades for loads moving eastward are three feet per mile greater on the Susquehanna route than on the Nineveh route. The length of line on which maximum grade rules is nearly twenty miles less on the Susquehanna than on the Nineveh route. The total rise eastward is 547 feet greatest on the Nineveh route. The total ascent, for both east and west, is 1088 feet greatest on the Nineveh route. The radius of minimum curvature is the most favorable, by 56 feet in 1000, for the Nineveh route. The total curvature is 882 degrees, or 2·45 circles, most favorable for the Susquehanna route. From Deposit, the line proceeds down the valley of the Delaware river about 40 miles, to the mouth of the Callicoon Creek. To this point it is common to the two routes between the mouth of the Callicoon Creek and the summit of the Shawangunk ridge, in Orange county.

The two routes between the points last mentioned, for the purpose of distinction, we call, one, the Sullivan county, or interior route, and the other, the Delaware river, or southern route.

The Sullivan county, or interior route, follows up the valley of the Callicoon Creek, thence crossing to the Mongaup and Neversink rivers, and over the dividing ridge, between the latter and the head waters of the Sandberg Creek, which it follows several miles, and thence by the Mamakating valley to the village of Wurtsboro. The distance from the mouth of the Callicoon to Wurtsboro is 52·58 miles. There are several different rates of ascending grade going eastward, the maximum of which is 45 feet per mile. From Wurtsboro, the line begins to ascend the north-western slope of the Shawangunk mountain, and reaches the point of junction at the summit gap in a distance of 8·56 miles, with a maximum grade of 45 feet per mile.

The Delaware river route continues down the valley of the Delaware river, from the point of divergence at the mouth of Callicoon

Creek. It occupies the New York side of the Delaware river for 20·23 miles, and then crosses it to the Pennsylvania side, and follows that side about 27 miles, where it re-crosses, and thence continues on the New York side to Port Jervis. The distance from the mouth of the Callicoon Creek to this place is 48·97 miles; the line then leaves the valley of the Delaware, crosses the table land and the valley of the Neversink, and ascends the north-western slope of the Shawangunk mountain, reaching the summit gap in a distance of 9·56 miles. The grade going east from the Callicoon to Port Jervis, is either level or descending; and from Port Jervis to the summit of the Shawangunk, the maximum grade is 50 feet per mile.

The following tabular statement shows the essential character of the two routes:—

	Delaware River Route.	Sullivan County, or Interior Route.
Maximum grade ascending east,	*50 feet per mile,	45 ft. per mile.
" " " " west,	15 " "	†57 " "
Number of summits,	1	5
Total ascent, east,	*454 feet,	1187 feet.
" " west,	316 "	1049 "
" ascent and descent,	770 "	2236 "
" length of line on which maximum grade rules,	9·56 miles,	61·14 miles.
Minimum radius of curves,	1200 feet,	955 feet.
Total curvature,	4588 degrees,	7609 degrees.
Length of lines,	58·53 miles,	61·14 miles.
Estimated cost of grading,	$1,496,430	$1,094,950
Length from the mouth of the Callicoon,	48·97 miles, to Port Jervis,	52·58 miles, to Wurtsboro.

The maximum grade of 45 feet per mile, rules for 61·14 miles on the interior route; and at 50 feet per mile for 9.56 miles on the river route. The total rise and fall is 1466 feet more on the interior than on the river route: the minimum radius of curvature 245 feet less favorable; and the total curvature is 3021 degrees, (equal to 8·39 circles,) less favorable on the interior than on the river route.

In considering the question of motive power on the routes in question, it becomes necessary to understand the influence of the adjacent parts of the road.

Commencing at the point near Binghampton, the road, westward of that place for more than 100 miles, has no grade descending eastward of more than 20 feet per mile. Consequently the trains will come to this point from the west, with loads adapted to a ruling grade of 20 feet per mile. With this load they would continue on the Nineveh route about 8 miles, to near Port Crane, and on the Susquehanna route, 23.6 miles, to near Lanesboro, in Pennsylvania.

* This applies only to the line from Port Jervis, 9·56 miles to the Shawangunk summit, and the Engineer, Mr Tracy, states this may be reduced to 45 ft. per mile.

† The Engineer, Mr Tracy, says this may be reduced to 48 feet per mile.

The extra power will, therefore, be the amount required above that necessary for a grade of 20 feet per mile. The two routes unite again at Deposit, on the Delaware. The line then runs down the valley of the Delaware, as before observed, 40 miles, to the mouth of Callicoon Creek, and is level, or slightly descending, eastward.

Between the Shawangunk summit and the Hudson river, at Piermont, grades of 60 feet occur.

If the Nineveh and Sullivan county lines were adopted, it would be a question of some practical importance to decide whether it would not be best to make up the trains moving east, (the direction of greatest load,) to go through to the Hudson without extra power. This course would render the level grade, of 40 miles on the Delaware, of little importance; but the inconvenience of changing the arrangement of trains for this distance, would probably counterbalance the advantage of doing so. If the system of extra power at the heavy grades be adopted for these routes, then, extra power must be provided to take a train due to a 20 feet grade, at Port Crane, (near the mouth of Page Brook,) and carry it over grades of 65 feet per mile, for a distance of 35·6 miles, to Deposit. At this place, a train due to a road nearly level, will proceed to the Callicoon, where extra power must be provided to carry it (over grades of 45 feet) to the Shawangunk summit—the entire length of this route. The same, or nearly the same, power would be required to proceed on to Goshen, and increased, so as to adapt it to a 60 feet grade, before the train leaves Orange county. Frequent changes of trains, or motive power, will be attended with inconvenience and extra expense, and in practice, the trains and power will be regulated to avoid changes as much as possible, especially if the road has only a single track.

It will be a near approximation, and simplify the comparison, to consider the routes for computation of motive power, to terminate for the Sullivan county, at Wurtsboro; and for the Delaware river, at Port Jervis. Considering the ascent from both these places to the Shawangunk summit as nearly the same, one 45, and the other 50 feet per mile, (and, as suggested by the engineer, the latter could be reduced to 45 feet,) the trains may be made up at these places respectively, to proceed over the ruling grades to the Hudson river, which are higher than either of the above. The train is then made up at Deposit for a level road and for the interior line; extra power is provided to carry it over the heavy grades between the mouth of the Callicoon and Wurtsboro, or for a distance of 49 miles; leaving the extra length of the line to Wurtsboro, over that to Port Jervis, for a separate estimate.

This arrangement, for a basis of comparative computation, will be as favorable for the interior lines as can be adopted; and it is proper to remark that, in any practical arrangement of business, the Commissioners are of the opinion it would be found most simple, efficient, and not less economical, to make up the train at Port Crane, in Broome county, to proceed to Deposit, and there adapt it to a ruling grade of 45 feet per mile, to be thence carried to the Shawangunk summit, and probably to Goshen. This mode of computation, however, would

present a less favorable result, as no benefit would appear for the 40 miles of level grade on the Delaware, above the Callicoon Creek.

It is important to this investigation to know the power and the cost of working locomotive engines.

The Commissioners have devoted their attention to this subject, and though it is one on which there is some conflict of opinion, the results arrived at in the following statement are believed to be sustained by the most extensive experience, where detailed accounts have been kept:—

Cost of Motive Power on Railroads, per Train, per Mile.

1st. Engine men, Firemen, and Station men:—

Baltimore and Ohio railroad,	5	cents.	
Utica and Schenectady "	8	"	
Reading "	4·55	"	
Boston and Worcester "	5·50	"	
Fitchburgh "	7·00	"	cts.
		30·05 ÷ 5 =	6·01
New York and Erie "	7·485		

2d. Fuel:—

Reading railroad,	wood, $3·50	23·70	
Boston & Worcester railroad,	" $4·90	22·20	
Fitchburgh "	" $4·25	14·17	
*Baltimore & Ohio "	coal, $2·00	8·00	
			68·07 ÷ 4 = 17·02
New York and Erie "		18·09	

3d. Repairs of Engines and Tenders:—

Reading railroad,	4·90	
Boston and Worcester railroad,	9·05	
Utica and Schenectady "	7·93	
Fitchburgh "	5·20	
Western, (Mass.,) "	6·50	
*Baltimore and Ohio, "	9·00	
		42·58 ÷ 6 = 7·09
New York and Erie "	8·75	

4th. Oil and Cotton waste:—

Reading railroad,	1·74	
Boston and Worcester railroad,	1·24	
Fitchburgh "	1·30	
*Baltimore and Ohio, "	1·46	
		5·74 ÷ 4 = 1·43
New York and Erie, "	2·94	
Carried forward,		31·55

* Estimate of coal trade in 1844.

	Brought forward,		31·55
5th. Interest on cost of Engines:—			
Baltimore and Ohio railroad,		3·01	
			=3·01
6th. Conductors and Brakemen:—			
Reading railroad,	4·11		
Fitchburgh "	6·20		
	10·31 ÷ 2 = 5·15		
Take 63 per cent. for brakeman, (which is the ratio on Reading road,) as conductors should not be included, and the expense for brakeman is	5·15 × ·63 = 3·14		
Do. Baltimore and Ohio railroad, as per estimate for coal trade,	= 2·40		
		5·51 ÷ 2 =	2·77
New York and Erie railroad,	= 6·52		
7th. Repairs of railroad, chargeable to locomotive and tender:—			
1st. Ordinary repairs; of these one-fifth is regarded as chargeable to motive power:			
Reading railroad,	13·66		
Boston & Worces'r, railroad,	18·00		
Boston & Lowell "	13·50		
Western, (Mass.,) "	13·75		
Baltimore & Ohio, "	18·30		
	77·21 ÷ 5 = 15·44		
and 15·44 ÷ 5		= 3·09	
2d. Deterioration of iron, not yet settled by experience. Half of this wear is believed to be chargeable to locomotives and tenders, on account of their greater weight. Suppose rail cost $7000 per mile, and will bear transport of 20,000,000 tons on a level road, average say 250 tons freight per train, equal to 80,000 trains. The cost per train will be $8·75; and half of this is		4·37	
			7·46
The weight of engines in the cases above detailed is not known, but is supposed to average less than fifteen tons on their driving wheels: to provide cost for an engine of 20 tons on driving wheels, would require an additional expense; but the fuel on the line of road under consideration would be less			
	Carried forward,		44·79

Motive power brought forward,	44·79
expensive, by about 7 cents, than the average for the same size of engine. In view of both considerations, it is believed, a reduction should be made from the preceding result of, say,	4·79
And the estimate for a 20 ton engine is =	40·00

Forty cents per mile run, for motive power with an engine of 20 tons on the driving wheels, appears to be about the cost, as indicated by the experience of the roads above quoted from.

It is difficult to obtain the items of expense, as very few railroad reports present the items separately; and where they are given, they frequently include expenses for both freight and passengers. The weight of trains has an influence on the cost per mile, and in providing for power, reference should be had to this circumstance. The range for a cord of wood is from 15 miles to 40 miles run, according to the weight of train and size of engine.

From the data above presented, with due consideration of the circumstances, we have come to the conclusion, that 40 cents per mile run with a 20 ton engine, is about the actual cost of motive power, including interest, and renewal of engines and tenders, and their proportion (according to the influence of their action on the road,) for repairs and maintenance of way.

Calculation of Motive Power required on Railroads.

Some difference of opinion exists as to the proper data for this calculation. It is generally considered, that an engine in good order will work up to the adhesion of its driving wheels. The main question therefore is, as to the ratio of this adhesion. In the most favorable state of the rails, this ratio may be taken at one-sixth the weight: but in many instances, slightly unfavorable circumstances in the rails, and the condition of the engine, will occur in the ordinary business of the road: and for general purposes, a ratio of one-eighth of the insistent weight is regarded as most favorable data for calculating motive power.

The friction of the cars is another element, and will depend on their condition. For general use, 8½ pounds per gross ton of car and load is considered a proper basis.

The ratio of the weight of freight to the gross weight of car and freight must be considered. Two-thirds is a common rule for a trade that admits of regularity, as coal, &c. For a general business, it is believed, the freight will be about six-tenths of the gross load of cars and freight.

An engine of 20 tons gross weight, all resting on the driving wheels, is assumed as the basis of the estimate—tender, 10 tons. The elements will therefore be:—

Engine = 20 tons = 44,800 pounds, all on the drivers

Adhesion = one-eighth the insistent weight.

Friction = 8½ pounds per ton; this is, essentially, equal to the resistance of gravitation, on a rise of 20 feet to the mile. Of course, for every 20 feet rise per mile, there must be added the power required to move the train on a level.

Ratio of freight to gross load, as 6 is to 10. 44,800 ÷ 8 = 5600 lbs. = tractile power of engine; 5600 ÷ 8½ = 658 tons, gross load, exclusive of engine.

The freight the engine will carry on different planes will be as follows:—

On a level,			658–10(the tender) × ·6 =	in gross tons			389
Ascent	20	ft. per mile,	(658-20) ÷ 2·00-10 × ·6 =	"	"		185·4
"	30	" "	(658-30) ÷ 2·50-10 × ·6 =	"	"		144·7
"	45	" "	(658-45) ÷ 3·25-10 × ·6 =	"	"		107·16
"	48	" "	(658-48) ÷ 3·40-10 × ·6 =	"	"		101·64
"	50	" "	(658-50) ÷ 3·50-10 × 6 =	"	"		98·22
"	60	" "	(658-60) ÷ 4·00-10 × ·6 =	"	"		83·7
"	65	" "	(658-65) ÷ 4·25-10 × ·6 =	"	"		77·7
"	68	" "	(658-68) ÷ 4·40-10 × ·6 =	"	"		74·42
"	74	" "	(658-74) ÷ 4·70-10 × ·6 =	"	"		68·55

The following table shows the ratio of freight carried by the same engine on different gradients; and also the multiplier or number of engines, required on different inclinations, to carry the same load—the unit being a level.

Grade of Road,	Ratio.	Multiplier.
Level, - -	1·000	
Ascending 20 feet per mile,	·476	2·098
" 30 " " -	·372	2·689
" 45 " " -	·276	3·630
" 50 " " -	·252	3·960
" 60 " " -	·215	4·647
" 65 " " -	·1997	5·006
" 68 " " -	·1913	5·227

It is necessary to consider the ratio of freight moving in different or opposite directions. No certainty can be arrived at as to this ratio. It will no doubt vary at different times. Probably an average of three tons will move east, to one ton west, and there can be no doubt, that the freight moving east will control the question of power, except on that portion which is in the valley of the Delaware river, where the return load of one-third the freight with the whole number of cars, will require greater power than the full load moving east.

The grade going eastward on the Delaware river has a maximum descent of 15 feet per mile, and assuming the ratio of freight to be 3 to 1, the result, as to the greatest load that can be carried on it, will be as follows:

The engine assumed, has been shown to be capable of carrying, on a level, a gross load of 648 tons, exclusive of engine and tender; or 389 tons of freight. The gross load the engine will carry up an ascent of 15 feet per mile, exclusive of engine and tender, is 357 tons. If the freight

be 358 tons, the gross load of cars and freight will be 596 tons. The cars for this load will be 238 tons. To return with one-third the freight, and all the cars, the load will be $358 \div 3 + 238 = 357$ tons. It has been shewn that 357 tons is the capacity of the engine on this ascent; consequently, the load moving east can only be 358 tons of freight. The load moving east is, therefore, restricted by the load moving west.

The gross load due on an ascending grade of 20 feet, is 309 tons, the freight 185·4 tons. The weight of cars required for this load is 124 tons. one-third the freight is 62 tons; together 186 tons. To return up a 74 feet grade, will require 63 per cent. additional power. It therefore appears, that the train engine, with a load due to a grade of 20 feet per mile, (this would be the train from Hornellsville to Port Crane,) moving east, would require extra power to return on the interior route from Deposit to Port Crane, equal to 65 per cent.

The investigation, as applied to the line between Deposit and Wurtsboro, shows the following result: Down the Delaware, it has been shown, the load is 358 tons of freight. That portion of the interior line embraced in this section has a return grade of, say, 48 feet per mile. [In the table it is given at 57 feet, but, as there noted, the engineer states it may be reduced to 48 feet.] To return with cars and one-third freight, over the interior portion of the section, gives a gross load of cars and freight of $358 \div 3 + 238 = 357$ tons. The engine will carry 169·4 tons up this ascent; consequently, 2·10 engines, or 1·10 extra engines, will be required to carry the return load.

From Wurtsboro to the Shawangunk summit, the line has a ruling grade of 45 feet to the mile. From Port Jervis to the same point, the ruling grade is given in the table at 50 feet, but the engineer states this may be reduced to 45 feet, in which case they may be regarded as the same. It will not be very material whether the latter is 45 or 50 feet, as the trains would, in practice, most probably be made up at either point so as to encounter the heavier grades, that occur towards the eastern termination of the road. This being about 70 miles, it is not probable there would be a second change of train for this distance. There will, therefore, be no material difference whether the computation for the purpose of comparison be made to the Shawangunk summit, or stop on one line at Wurtsboro, and on the other at Port Jervis.

For the computation of extra power, it is proposed to take the Hornellsville train, which will be loaded for a 20 feet grade, and by extra power carry it over the heavy grades to Deposit. At this place make up a train that will be suitable for the Delaware river section, and provide extra power sufficient to carry it over the heavy grades between the mouth of Callicoon Creek and Wurtsboro; leaving the trains to be there made up either at Wurtsboro or Port Jervis, for the heavy grades between those places and Piermont. This method will require but two changes of trains between Binghampton and Pierpont, and in view of the whole subject is regarded as presenting a fair basis for comparing the two lines. It gives the interior route the full benefit of the favorable grade on the Delaware, between Deposit and the mouth of the Callicoon, which may not, and probably will not, be wholly available in practice; and the river route has some additional

elevation between Port Jervis and the Shawangunk summit, which may be regarded as a partial offset.

It has been shown that extra power will be required mainly as aid to the train moving eastward, and that a portion of this power will be required for the return train. A part of the extra power required to move the train eastward might be dispensed with when it reached the last summit of the ruling grade. There will, however, be practical difficulties in this. It will cause too much change in arranging the power, and tend to confusion in conducting the business of the road; and it will deprive the heavy trains of the power that is sometimes quite necessary, and generally a convenience, in regulating their descent on the heavy grades. There are times when the state of the rails is such that it is impossible to control the trains on a heavy descending grade by means of the friction brake alone—where the power of the engine is indispensable; and even that is not always sufficient. In view of all the circumstances, there can be no doubt the most judicious business arrangement would be to run the extra power over the whole section affected by the ruling grade, both ascending and descending, in the direction of the greatest trade. As the extra power must run in both directions over the section requiring its aid, it will always be competent to carry the return load; and as the load eastward will determine the amount of extra power necessary to be provided, the computation will be simplified by considering it charged wholly to the freight moving in this direction. The engines must return, and though partially loaded with the train moving westward, the expense or comparison will not be affected, whether it be charged in this manner, or divided between the freight in both directions. The total cost of extra power will be therefore charged on freight moving eastward.

It has been shown that the cost of running an engine weighing 20 tons, and capable of carrying a train of 389 tons freight on a level, will be 40 cents per mile run. It is, however, well known that extra power, kept in readiness for running at intervals, and for short distances, cannot be maintained at the same expense per mile run, as a regular train engine. The extra power must be adapted to the load, and this may require more than one, and less than two engines; consequently, two must be employed. Two or three engines coupled to the same train, will not perform as much, in proportion to their power, as if worked separately; and if the train is separated, and made up into several smaller ones, delay and expense are incurred. The power must be provided for a full load; but a general trade will be more or less irregular, and as the trains working on a long road must move at regular times, they will not always be full loaded, and the average will fall considerably below the capacity of the engines. This remark applies to the question of power generally, and is not peculiar to the provision for extra power. We are of the opinion that this extra power, for the reasons above given, will cost not less than 50 per cent. per ton of freight per mile, more than that of engines in regular work, and carrying loads equal to their full capacity. The ratio of increase in cost, from the considerations above stated, cannot

be arrived at with certainty, and though we think it will exceed the regular computation more than 50 per cent., this ratio will be assumed in the following estimates.

Collecting the data that have been presented, we now proceed to give the expense of extra power, and make a comparison of the several routes, on the basis that has been submitted.

Nineveh, or Interior Route.

The extra power to carry a train due to an ascending grade of 20 feet per mile up a grade of 65 feet per mile, (the ruling grade on this route,) is 1·386, or nearly 1·4 engines. We have, then,

$40 \times 2 \times 1{\cdot}386 \times 1{\cdot}5 = 166{\cdot}32$ cents per mile run, with a load of 185 tons; $166{\cdot}32 \div 185 = 0{\cdot}9$ cents per ton per mile.

This route is 4·29 miles longer than the Susquehanna, or southern, route. For this distance, the whole cost of transportation, exclusive of depot expenses, is chargeable to the interior route. This, on a ruling grade of 20 feet per mile, ascending in the direction of the greatest trade, is estimated at one cent per ton per mile on the freight carried in both directions. The freight going westward is estimated at $\frac{1}{3}$ of that going eastward, and hence a charge of $1\frac{1}{3}$ cents per ton per mile, on that moving eastward, will cover the cost on freight in both directions.

The extra expense all computed on freight going eastward, will be per ton as follows:—

On 35·6 miles, (length that heavy grade rules,) at the rate of 0·9 cents,	32·04	cents.
On 4·29 miles, extra length of line, and to cover freight in both directions, though only chargeable on that moving east, at the rate of $1\frac{1}{3}$ cents,	5·72	"
Per ton of freight,	37·76	"

Susquehanna, or River Route.

The extra power to carry a train due to an ascending grade of 20 feet per mile, up a grade of 68 feet per mile, (the ruling grade on this route,) is 1·491, nearly $1\frac{1}{2}$ engines: computed on the basis above adopted, is,

$40 \times 2 \times 1{\cdot}491 \times 1{\cdot}5 = 178{\cdot}92$ cents per mile run, with a load of 185 tons. $178{\cdot}92 \div 185 = 0{\cdot}97$ cents per ton per mile.

The length on which ruling grade prevails is 15·66 miles, at 0·97 cents per mile, = 15·19 cents.

Comparison of the two routes:—

Nineveh route,	37·76	cents
Susquehanna route,	15·19	"
Difference in favor of Susquehanna route,	22·57	"

(To be continued.)

On the Law which governs the Resistance to the Motion of Railway Trains at High Velocities. *By* Mr. Scott Russell.

Having on former occasions communicated the results of experimental researches concerning the resistance experienced by floating bodies moving along the surface of water at high velocities, I have thought it not an inappropriate sequel to communicate the general result of a long series of experiments made partly by committees of this Association, and partly by myself. The subject of the resistance which requires to be overcome in order to give motion to trains at high velocities, has been matter of great uncertainty, some dispute, and the cause of several grave errors in practical engineering. Some six years ago, a committee of the Association was appointed to make experiments on this subject, and these experiments were at the time a valuable addition to our knowledge. They showed that the resistance at such velocities as 36 miles an hour was much greater than had been supposed—at least double. The committee, however, in concluding their labors, stated that they were not able to deduce from them any law, or semblance of a law; that the resistance increased with the velocity,—but it did not appear to do so according to any simple function of the velocity, neither as the velocity directly, nor as the square of the velocity. Since that time, the question has been a *quæstio vexata* among practical men and mathematicians. A paper read at the Royal Society last winter comes to the same conclusion as the old committee of the British Association, viz.—that no law is manifested in the experiments,—of which, at high velocities, the results are quite anomalous. The consequences of errors on such a point have become now so serious, especially where velocities of 50 or 60 miles an hour are attempted, that it has been reckoned desirable that the question should be, if possible, thoroughly resolved. For this purpose, I have undertaken a series of practical experiments, on a large scale, with railway trains of a great variety of size and weight, and at velocities as high as 61 miles an hour. They were made on the South-Western, London and Brighton, South-Eastern, Sheffield and Manchester, and Croydon atmospheric railways. I have combined with these, the experiments formerly made by the British Association, and some by Mr. Harding, on the broad gauge; and it is the result of this great variety of facts which I wish to lay before the Section.

The following experiments show the great amount of resistance at high velocities; but they also show the apparent anomaly of the results. We have many higher velocities than others with much lower resistances. These are the difficulties in the way of any simple and apparent solution. The method of investigation I have adopted is this—I have taken all the results of experiments, and removed from them, in the first instance, all the questionable experiments. I found it necessary to discard all the experiments made with accelerating velocities, and to retain only such as were made on uniform velocities, in the same circumstances, over a large space; most of my own experiments having a steady uniform velocity over from one mile to six.

I have also selected those which were most free from the action of wind—an element of much importance. By thus weeding out the experiments, and taking only the most unquestionable, I simplified the subject very materially. Those which remain are given in the table.

No. of Experiment.	Uniform velocity maint'nd in miles per hour.	Resistance in lbs. per ton by experiment.	Resistance in lbs. per ton by formula.
1	10	8·40	9·30
2	14	12·60	13·90
3	14	12·60	13·90
4	29	16·50	15·70
5	31	23·30	25·40
6	31	18·20	16·30
7	32	22·50	27·20
8	33	22·50	22·70
9	33	15·68	16·90
10	33	15·96	17·00
11	34	16·60	17·30
12	34	16·95	17·30
13	34	17·70	17·30
14	34	23·30	27·20
15	34	25·00	23·10
16	35	22·50	26·10
17	36	22·50	22·40
18	36	22·40	21·50
19	37	17·50	18·20
20	37	25·00	28·40
21	39	30·00	31·00
22	41	22·99	19·60
23	41	26·78	19·60
24	45	21·70	21·00
25	46	23·10	21·30
26	46	30·31	31·00
27	47	33·70	33·10
28	50	32·90	36·30
29	51	26·40	23·00
30	53	41·70	42·10
31	61	52·60	54·80

In this table, the weight of each train, in tons, is shown, and the number of pounds of force required to keep each ton weight of that train in motion at a given number of miles per hour, is shown by actual experiment. The analysis of those experiments I made as follows:—I take the friction of the axles and wheels as an ascertained quantity, equal, in the best conditioned carriages, to 6 lbs. per ton of train. This, I conceive, we may consider to have been proved by all experiments of friction, including those of Mr. Morin, the latest and best, to be a source of resistance constant at all velocities. This I call friction proper, and I consider it as the first element of resistance. Friction proper, the first element of resistance,—or

[1] $$R_1 = C\,m,$$

Where $C = 6$ lbs., and $m =$ the mass of the train in tons weight.

The second element of resistance is the resistance of the air to the front of the train. This has been variously estimated, and somewhat

erroneously. Some persons have taken for it Smeaton's tables of the force of the wind. But such a table gives a quantity quite in excess; for these tables were made from the force of the wind upon a *thin* plate, a case where the minus pressure behind is added to the plus pressure before the plate; whereas, in the case of the railway train, there is a solid body, whose third dimension extends the whole length of the train. I have therefore taken, not the table of the force of the wind, but a table of the resistance of air calculated from the height due to the velocity, which I have found to represent most accurately the resistance of fluids to bodies passing through them; and I have taken this as the second essential element in the resistance to railway trains. Resistance of the air, the second element:—

[2] $$R_2 = A\,p\,v^2,$$

Where A = the area, in square feet, of the front of the train, and p = weight of a column of air, whose base is a square foot, and whose length is the height due to the velocity of one mile an hour; v being the velocity of the train.

After having deducted from the results of the experiments the sum of these two resistances, I have found a large amount still unaccounted for; and I find this quantity to be not only large, but dependent also on the velocity. The question which I now submit to the Section, is the determination of the nature and cause of this third element of resistance. The third element of resistance appears, by the experiments, to increase very nearly as the velocity; simply, that is, it amounts, at 10 miles an hour, to about 3 lbs., at 30 miles an hour, to 10 lbs., and at 60 miles an hour, to 20 lbs. per ton. It is, therefore, proportioned to the mass, or weight, of the train, and to the velocity jointly. Other resistances due to velocity, or third element:—

[3] $$R_3 = B\,m\,v,$$

Where $\frac{1}{3}$ lb., m, the weight of the train in tons, and v, its velocity in miles an hour.

Whence the total resistance (R,) to any train of any weight, moving with any velocity, is to be obtained from the formula

[4] $$R = R_1 + R_2 + R_3 = A\,p\,v^2 + B\,m\,v + C\,m.$$

The results of this formula are shown in the last column of the table; and from the close manner in which they follow the experiments through their various and apparently anomalous results, they may be regarded as an approximation to the truth sufficiently close for all practical purposes. The next question discussed, was the nature of this third element—resistance. The author attributed it mainly to the concussions, oscillations, frictions, and flexures, to which all the portions, both of the train and permanent way, are subject, at high velocity.

Dr. Robinson observed that this was a subject on which we had been for some time very much in want of accurate information, and he was very glad it had been taken up by Mr. Scott Russell; who would, he hoped, throw as much light on the resistance to railway trains as he had already done on the resistance to ships moving through

the water. He quite agreed with him as to the nature of the first two elements of resistance forming two terms of the formula. He also agreed, to a certain extent, to the existence of the third element, which Mr. Russell represented by the term B *m v*. But he hoped the experiments would be extended, and that this term, instead of appearing as it now did, would be analyzed into some further elements. He had paid some attention recently to this subject, and had stated his views to the Committee of the Houses of Parliament, before which he had been examined, on the atmospheric railway; and he conceived that there existed a term of resistance due to the imbedding of the wheel in the rail, which would be of some such form as B $m v_{\frac{1}{2}}$. There would also, he thought, be another term due to the resistance of the spokes of the wheel, and another due to the adhesion of air to the sides, consisting of two terms,—one increasing as v, and another as v^2. These, with axle furniture, rolling friction, and the other elements he mentioned, would be found to be concealed under the present aggregate B v m; and he sincerely hoped these researches would not cease until the analyses were thus rendered complete.—Mr. Scott Russell concurred in the views of Dr. Robinson, and would not fail to prosecute the subject. He thought it of especial importance from this fact, that the element, or group of elements, represented by B v m, was large, and, practically, very important; but it was also one which the skill of the engineer might very much diminish, by attending to the construction of the permanent way, and the improvement of the carriages.— *Transac. Brit. Assoc.* Lond. Athenæum.

AMERICAN PATENTS.

List of American Patents which issued in the month of March, 1846,—with Exemplifications, by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For *Improvements in Chimney Caps, for Ventilating Apartments;* Moses Chase, Boston, Massachusetts, March 7.

The following extract and claim, taken from the specification, will give the reader a clear idea of this improvement, viz:—"As ventilators have heretofore been constructed, they have only served the purpose of discharging the foul air from the apartment, or increasing the draught in a flue by the action of the external current of air near their discharging mouth. By my improvements, I effect, in addition to the result above suggested, the introduction of a current of fresh air from the windward end of the horizontal tube of the ventilator, which greatly facilitates ventilation, and assists, in some degree, the discharging operation from the leeward end of said horizontal tube.

"When my apparatus is used to increase or improve the draught in chimney flues, I carry the descending, or fresh air tube, down a proper distance in said flues, and I apply to the lower end of the de-

scending tube a reflecting cap having a cylindrical part larger in diameter than the lower end of said tube, and a conical bottom, which reflects the downward current of fresh air in the tube in a manner which will be readily comprehended."

Claim.—"What I claim, therefore, as my invention, and desire to have secured to me by letters patent, is a ventilator, or chimney cap, (with a horizontal turning top,) *having a descending flue, or tube, for the introduction of fresh air, opening from the windward end of said horizontal turning top, and passing down through the discharging flue, or tube, and below the bottom of the same, as herein set forth;* the whole arrangement being substantially as hereinbefore specified.

"I also claim the combination of the reflecting cap with the bottom of the descending, or fresh air tube, the arrangement and purpose of the same being substantially as above set forth."

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2. For an *Improvement in Setting Logs on the Carriages of Saw Mills;* George Sweney, Bucyrus, Crawford county, Ohio, March 7.

The claim in this patent is wholly dependent on the drawings, the publication of which would carry us beyond our limits, considering the nature of the invention, which is, in the patent, limited to the combination of certain levers, connecting rods, and their appendages for raising the head end of the log, to move it sidewise to the required distance.

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3. For *Improvements in Cooking Stoves;* R. D. Granger, Albany, New York, March 7.

These improvements are applied to the double oven stoves, that is, to that class of stoves which have two ovens, one back of the fire chamber, and the other below, with a horizontal flue between the two, the lower oven extending under the fire-place. The rising flue, at the back of the bottom oven, instead of being vertical, rises in a semicircle, to throw the heat as far under the upper oven as possible before it turns back to pass through the flue at the back of the upper oven. This is covered by the first section of the claim. And the second improvement relates to the introduction of a draught to the under part of the grate through a tube placed in the direction of the horizontal flue between the two ovens, and passing through the front diving flue; and also to the introduction of a draught of air through a register at the top of the stove, and above the fire chamber.

Claim.—"I claim the *curved* flues in the rear of the lower oven, as herein shown and described, serving to throw the heat somewhat backwards upon the bottom plate of the upper oven.

"I also claim combining with the two ovens and their respective flues, the upper and lower draught, and arranged and operating substantially as set forth."

4. For *Improvements in Saw Mills ;* Russel S. Morrison and Benj. B. Cushing, Frankford, Waldo county, Maine, March 7.

Instead of having but one carriage, as usual, with the head block at one end, and the tail block at the other, there are, in the invention before us, two carriages, one having the head block, and the other the tail block, and each carriage moves independently of the other. Two rollers are placed, one in front and the other back of the gang of saws, to sustain the log, and back of the saws there are two sets of thin wheels, one above and the other below the log, and running in the saw carfs to guide the log, and sustain the several boards that are being cut in their proper relative positions. The log, instead of being supported on the head and tail blocks at the same time, is first clamped on the tail block, which moves with one of the carriages, to present the head end of the log to the gang of saws, and feed it forward until cut through sufficiently to have the head end received and clamped on to the head block of the other carriage, which continues to move the log until it is cut through; the carriage of the head block, in the meantime, being carried back to receive another log.

Claim.—"Having thus described our invention, what we claim as new, is the combination of the two carriages and sustaining rollers, or other mechanical equivalents, with one or more saws; the whole being arranged and operated substantially as specified.

"We also claim the employment and use, in combination with the saws and carriages, of one or more series of circular or other proper-shaped revolving guide plates, the same being for the purpose of preserving the boards, or sawed sections of the log, in their vertical or true positions, as above explained."

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5. For an *Improvement in Pistons for Pumps, Steam Engines, &c., called the "Rolling Segmental Frictionless Piston ;"* David Hinman, Brunswick, Medina county, Ohio, March 7.

This invention consists in substituting for the metallic, or other packing, and the hinged flap, the rolling of metallic or other hard substances on each other, by making the piston of three, four, or more triangular parts, turning on rounded edges along the outer faces of the triangles, the outer faces being made in the form of segments of cones, and rolling on each other when moved together in the same direction—all the segments being jointed to one piston, or connecting rod. The effect of their vibration will be similar to the working of the flap of a bellows.

Claim.—"What I claim as my invention and desire to secure by letters patent, is composing a piston of three or more segments, rolling on each other as they vibrate together, each on a separate axis, along or near to their outer edge, substantially as herein described."

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6. For a method of *Preventing the Hatches of Vessels from Leaking ;* Richard C. Holmes, Cape May, New Jersey, March 7.

The nature of this invention consists in making a groove, or gutter,

in the upper face of the frame of the hatch-way, over which the hatch, or cover, rests, to catch the water that may leak through the joints, and discharge it on to the deck through apertures or tubes leading from the bottom of the groove, or gutter, to the outside of the frame; the said apertures being governed by valves opening outwards, to permit the escape of the water, and prevent a sea, in passing over the deck, from entering the valves.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method, herein described, of preventing the hatch-ways of vessels from leaking, by making a groove, or gutter, in the framing on which the hatch, or cover, rests, with apertures or tubes leading therefrom to the outside of the framing, in combination with the valves governing these apertures, and opening outward to permit the escape or discharge of water from the groove, or gutter, and prevent water from washing in, as herein described."

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7. For an *Improvement in Separating the Grain from the Straw in Threshing Machines;* Pliny Weller, Fowlersville, New York, March 7.

The straw and grain are thrown from the threshing machine into a rotating cylindrical screw, from which the straw is discharged on to an endless apron, to be carried off, while the grain which passes through the meshes of the screen, is delivered on to another apron, below the straw apron, to be delivered to another rotating screw, to be separated from the chaff by a fan.

Claim.—"I do not claim to be the inventor of the threshing apparatus, or of the revolving screws or of either of the parts thereof, taken separately; but what I do claim as new, and desire to secure by letters patent, is the manner in which I have combined and arranged these parts, so as to produce a new and useful effect; that is to say, I claim the combining of the two rolling screens with the two endless aprons, so as to effect the separation and cleaning of the grain, in the manner set forth."

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8. For an *Improvement in Filters, for Filtering Water and other Liquids;* Wm. H. Jennison, New York, March 7.

The patentee says,—"Of the various substances which have been employed as filtering media, sponge has heretofore been deemed the least useful, from the circumstance that in its natural, or slightly compressed state, its pores readily admit and become clogged with the impurities, and in a very short time impede the passage of the liquid, and after these impurities have filled up the pores it is very difficult to remove them; but by a series of experiments, I have ascertained that by submitting well cleansed sponge to a pressure of about five thousand pounds, and retaining it in this compressed state, it will admit of the passage of water or other liquid through it, and retain the impurities outside. Having ascertained this fact, I have applied sponge thus compressed to the filtering of water and other liquids with great advantage in the following manner. The sponge is torn

into small fragments, and properly cleansed, to remove all impurities, and then, in a moistened state, I compress it under a pressure of about five thousand pounds, and confine it between two perforated metallic plates, forming a diaphragm, which is placed in a case with a chamber on either side, so that the water or other liquid can be carried through it, first in one direction, and then in the other, so that the impurities which are deposited alternately on its opposite surfaces, shall be readily carried off by the water, or other liquid."

Claim.—"What I claim as my invention and desire to secure by letters patent, is forming a filtering medium, for filtering water and other liquids, of sponge, compressed under a sufficient pressure to prevent sediment from entering the pores thereof, and permit pure water, under pressure, to pass through, as described; the sponge thus compressed, being confined and retained between two perforated plates, as described."

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9. For *Improvements in the Machine for Reaping Grain;* Wm. F. Ketchum, Buffalo, New York, March 7.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the manner of constructing the rake teeth, the same consisting of two plates of unequal length, and each set being made separate, and not a whole plate, as heretofore. I claim, further, the arrangement of having the operating parts, as the driving wheels, under the platform on which the cut grain falls, as illustrated in the specification and drawings.

"I claim in particular, using one or more revolving sharp-edged shafts, for the purpose to carry the cut grain from the knife-blade to the platform, in the manner set forth."

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10. For an *Improvement in the Manufacture of Soap;* Dominique Frick Albert, a citizen of France, now residing in Manchester, England, March 7.

Claim.—"What I claim as my invention, is the saponization of animals' entrails, or butchers' offals, by the means of a strong caustic alkali, in the manner and for the purpose set forth and described."

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11. For *Improvements in the Mortise Door Latch;* Rodolphus Kinsley, Springfield, Massachusetts, March 7.

The patentee says,—"In making mortise latches, much difficulty has been experienced in giving a form to the case to suit thin doors, and at the same time adapted to the reception and working of the mechanism, and the fitting of a mortise made entirely by boring, to avoid the labor of mortising with a chisel. This end has been sought by substituting the cylindrical for the square form; but to adapt this to the reception of a properly formed tumbler, requires too great a diameter to suit a medium thickness, or thin door. But, by one of my improvements, I attain this desideratum by forming the cross section

of the case of three circles; one in the middle, to form the thickness of the case, and two small ones, one on each side of, and bisecting, the middle one, to form the width of the case, so that a hole formed by boring one large hole and two small ones, will receive the latch case, the diameter of the large one being sufficient to give to the arch of the tumbler the required length, and the two small ones giving sufficient width for the working of the levers of the tumbler and the wings of the latch bolt, on which the tumbler acts, to operate it.

"My second improvement consists in so locating the helical spring which protrudes the bolt, within a recess therein as to have one portion of it rest on a flanch connecting the two sides of the bolt, and the other end on a shoulder of the stud against which the permanent end of the spring rests; by means of which arrangement, much of the friction, and consequent wear, of the spring against the case, is avoided."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the form of the case of mortise latches by the union of three circles, one large one in the middle, and a small one on each side, the three intersecting each other, substantially as herein described, to leave greater strength in the wood of the door on each side, as specified, and to admit of fitting into the door by boring simply.

"I also claim locating the helical spring in a recess in the body of the latch bolt, in combination with the mode of preventing friction and wear, by sustaining one end on a flanch, or plate of the bolt, and a shoulder on the standard, as herein fully explained."

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12. For an *Improvement in Door Locks;* John H. Davis, Lumberville, Bucks county, Pennsylvania, March 7.

The patentee says,—"The nature of my invention consists in fitting up the lock with revolving escutcheons, connected with a wheel inside the lock, in which there is a hole only large enough to admit the key, so that when the key is turned in the lock, the key-hole will be closed on both sides; and by means of a notch in said wheel, into which a pall falls, the escutcheons are fastened in a position covering the key-hole when the door is locked; the catch of the latch is so constructed that it can be reversed, making the lock a right or left-hand one, at pleasure."

Claim.—"Having thus fully described my improvements, I wish it to be understood that I do not claim as my invention a revolving wheel, or cover, for a key-hole in a lock, as that has before been applied; but what I do claim as my improvement and desire to secure by letters patent, is the combination of the revolving escutcheons and wheel with the bolt and pall, in the manner described, so that when the bolt is locked, and the key-hole closed, the lock is perfectly secure from attempts outside, and when drawn back, it can be locked equally well from either side."

13. For an *Improvement in the Manufacture of Soap ;* Jacob Keen Vaughan and Evan Henry Everman, Philadelphia, Pennsylvania, March 7.

The following is extracted from the specification, viz :—"The specified quantity of ingredients for compounding 3000 lbs. of improved soap are as follows:—best yellow soaps, 900 lbs.; water, 2100 lbs.; boras sodæ, (or common borax,) 75 lbs.; sodæ murias, (or common salt,) 37½ lbs.; glue, best manufactured, 15 lbs.; palm oil, 10 lbs. Dissolve the soap in the water by slow boiling, then add the glue (in a dissolved state) and the palm oil, and continue the boiling and stirring until brought to a boil, then add the borax and salt; leave the mixture to boil a few minutes, when it is finished, and may be poured into moulds to cool."

Claim.—"What we claim as our invention and desire to secure by letters patent, is the application and addition, to a given quantity of soap, of water, borax, salt, glue, and palm oil, which will increase the quantity, and improve the quality, of the soap used, as herein described."

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14. For an *Improvement in the Machine for Planting Corn and other Seeds ;* James Putnam, Hamilton, New York, March 7.

The tooth which forms the furrow, is made with wings of teeth on each side. The following extract will explain the nature of the second improvement claimed:

Claim.—"What I claim as new, and desire to secure by letters patent, is the combining of the lateral rakes with the furrower, for the purpose of preventing the coverers from drawing in of stones, or other hard substances, over the seeds. I claim the device described, for the checking of the shafts, as set forth, in order to facilitate the turning of the machine at the expense of each furrow."

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15. For *Improvements in the Permutation Lock ;* Francis B. Pye, New York, March 7.

The patentee says,—"In my improved lock, the key is surrounded by a hoop, which is nearly equal in depth to that of the bit of the key; this hoop, however, does not constitute a perfect cylinder, an opening being left in it which is to be occupied by the end of the bit when the key is inserted. Above this hoop, there is a revolving circular plate that is received within a groove in the face plate, or cover, of the lock; through this plate the key hole is made, and it is turned round by the bit of the key, along with the hoop above named. The pin that receives the barrel of the key is not in the centre of the hoop, and as it is turned round, the acting part of the bit projects beyond the hoop, and operates upon a set of levers which I denominate the key levers, and raises these levers to different heights, governed, of course, by the arrangement of the parts of which the bit of the key is composed, and upon which the permutation is dependent. As these levers are raised, they act upon another set of levers, which I denominate the interme-

diate levers, and these operate upon a third series, which, as they are immediately connected with the bolt, I denominate the bolt levers. It will be seen by those who are acquainted with the manner of constructing the several permutation locks that have within a few years been the subject of letters patent, that I dispense entirely with the slides and tumblers used in most of those locks, and substitute therefor, levers working upon suitable fulcra, or pivots, and it is from this circumstance that I have been induced to denominate my lock the *permutation lever lock.*"

Claim.—"I do not claim as of my invention either of the parts of this lock taken individually, but only as combined and co-operating with other parts, in the manner set forth; but what I do claim as new and of my invention, is, first, the manner of arranging and combining the hoop with the revolving plate, the partition-piece, and with the key levers; the pin that receives the barrel being placed eccentrically with the hoop, and the hoop and the plate revolving with each other, as described.

"I also claim the manner set forth of arranging and combining with each other the key levers, the intermediate levers, and the bolt levers; the whole of them having fulcrum pins on which they rise and fall, and not operating as slides in a direct line; by which arrangement, they are rendered more certain in their action.

"I claim the manner in which I have arranged and combined the auxiliary levers with the clawed talons, the bolt levers, and with the respective studs, so as to operate for the purpose and in the particular manner herein set forth. I do not claim the use of talons with claws to engage in notches, or teeth, on slides; but I limit my claim to the special arrangement herein made known.

"I claim the manner of employing a latch in combination with the bolt, levers, lifting-piece, and the spring for the purpose of preventing the pushing back of the bolt when it is but partially shot out, the respective parts concerned in this operation being arranged and acting substantially as described."

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16. *For Improvements in Night, or Safety Latches;* Amos Call, Springfield, Massachusetts, March 7.

The patentee says,—"The invention consists in having one of the knobs of the latch so fixed as that it can be connected with the tumbler, or disconnected, at pleasure, and when on the outside of a door it can be controlled by a person inside; whilst the inside knob is so affixed to the spindle as always to act on the tumbler in the usual way. This improvement can be applied to all varieties of latches moved by a revolving spindle and tumbler."

Claim.—"What I claim as my invention and desire to secure by letters patent, is connecting the knob of a latch with the spindle in such a way as that it can be made to turn either with or without the spindle, by means of a bolt acted on the opposite side of the door, to control the action of said knob, substantially in the manner and for the purpose herein set forth."

17. For *Improvements in Machinery for Reaping, Threshing, and Cleaning Grain;* Jeremiah Darling, Adrian, Michigan, March 7.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the carrying or gathering platforms, formed of slats with pointed teeth thereon, and moved substantially as described, with the cutting and threshing apparatus, as set forth.

"I also claim the mode of steering by pivot wheels, in combination with the reaping apparatus, as described."

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18. For an *Improvement in the Pump for Gauging the Quantity of Liquor to be Drawn;* Daniel Hunsicker, Hartleton, Pennsylvania, March 7.

The improvement claimed consists in connecting with the piston rod of a suction pump a sliding gauge, which, when set, determines the distance to which the piston shall move, and thereby measures the quantity of liquor to be delivered.

Claim.—"I make no claim to the pump, but only to the additional apparatus with it, by which it is adapted to the drawing of molasses, oil, and other articles in any required measure, by atmospheric pressure and lever power—that is to say, the scale, stop lever, slide, and spring."

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19. For *Improvements in Stop Cocks and Valves for Hydrants, and other purposes;* F. H. Bartholomew, New York city, New York, March 7.

The patentee says,—"The nature of my invention consists in an improvement in the construction of pistons for valves, or stop cocks, which, by the action of the water and atmosphere, shall close so gradually and gently as not to destroy lead pipe by concussion, and by which, also, when applied in combination with a plunger for hydrants, shall form a chamber, into which a portion of water in the hydrant may recede below the action of frost, and not waste into and saturate the earth."

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is the combination of the plunger with the piston or valve cock, in the manner used for the purpose described. Also, I claim the combination of the plunger and piston with the hydrant, substantially as described, said combination effecting the double purpose of checking the concussion from the water and of furnishing a variable chamber, in which the waste water may descend away from the influence of frost, and not waste away into the ground.

"I also claim the construction of the piston by which the aperture is closed before the full closing of the valve, and which, when combined with the plunger, shall furnish a variable chamber, for the purpose herein set forth."

20. For a *Machine for arranging the Blanks for Screws, or Pins, to deliver them to Machinery in which Wood Screws, or Pins, are to be manufactured;* Solyman Merrick, Springfield, Massachusetts, March 7.

The blanks are thrown promiscuously into a hopper, formed by placing a frustrum of a cone within an inverted frustrum of a hollow cone, the lower edges of the two being placed at such distance apart as to leave a space wide enough to receive the shanks of the blanks, but not the heads; and, therefore, when motion is given to the inner cone, it agitates the blanks, which drop in their places heads up, and carries them around to a slot, where they are delivered in succession, and in a proper position.

Claim.—"I therefore claim the combination of the conical hopper, one, or two, or more conic frustra, a partition, and a delivery apparatus, arranged and operating together substantially as specified. Also, the combination of the revolving beater with the conic hopper and one or more frustra, or other mechanical equivalents, the whole being disposed and operating together in the manner and for the purpose as above specified."

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21. For a *Process for procuring White Rosin and a pure White Spirit of Turpentine from raw Turpentine;* Nicholas U. Chaffe, Charleston, South Carolina, March 14.

The patentee says,—"The nature of my invention consists in the application of steam generated from water in a common boiler, and conducted by wood or metal pipes into a wood still containing the gum, which causes the spirits to rise and pass through a metal heater contained in a second wood still, and from thence to a worm, or condenser, from which is produced a pure white spirit of turpentine. After the spirit is off, the gum, or white rosin, is conducted into a metal vessel, under which a slow fire is kept, until the water is evaporated, when the rosin is transparent, or crystalized."

Claim.—"What I claim as my discovery and desire to secure by letters patent, is the manufacturing of white rosin and white spirits of turpentine from the gum of Pines, either dip or scrape, by the application of steam generated from water, in a common boiler, or still, and conducted through wood or metal pipes into a wood or metal still, mixing with the gum, and then passing through a metal heater, as herein described."

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22. For an *Improvement in Separating Grain from Straw when it leaves a Thrashing Machine;* John Blue, Covert, Seneca county, New York, March 14.

This improvement consists "in forming the endless belt, by attaching every alternate slat to two narrow endless belts of leather, and connecting the other slat to these, instead of attaching them directly to the leather belts, so that as each slat that is attached to the leather

belts begins to pass up around the lower roller, the one attached to it is thrown open, or out of the curved line formed by the leather belts, and thus leaves a free discharge for straw, or any other substance that may have fallen through."

Claim.—"What I claim as my invention and desire to secure by letters patent, is forming the endless belt of slats, for carrying up and separating the grain from the straw, by attaching or jointing the alternate slats to those which are attached to the belts, or chains, which connect the whole together, substantially as herein described, to form openings for the discharge of straw, grain, or foreign matter, as herein described."

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23. For *Improvements in Carriages;* Starr Fairchild, Trumbull, Connecticut, March 14.

Instead of the usual perch and elliptic springs, and the fifth wheel on the fore axle, the fifth wheel is placed midway between the two axles, and the half of semi-elliptic springs extend from the rear axle to the lower plate of the fifth wheel, and in like manner from the fore axle to the other plate of the fifth wheel; and the former of these plates is also attached to the middle of reversed elliptic springs, the ends of which are secured to the carriage body; the whole constituting the springs and perch.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the fifth wheel, and springs, and stays suspended between the axles under the bodies of carriages, in the manner and for the purpose herein set forth."

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24. For an *Improvement in the method of Transporting, Washing, and Separating Coal;* John G. Brant, Cumberland, Maryland, March 14.

The broken coal is carried down an inclined shoot by a current of water, and this shoot is provided with branches and grates, so that the largest lumps, which are arrested by the first grate, pass into the first branch; the next size, in like manner, into the second branch; and so on, to the end; the water at the same time washing the coal, and carrying off the dirt and other impurities.

Claim.—"What I claim as my invention and desire to secure by letters patent, is conveying, washing, and separating coal simultaneously, by a current of water, in the manner above described, or other mode substantially the same."

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25. For an *Improvement in Dyeing Furs, &c.;* Denison Williams, Albany, New York, March 14.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the mode of dyeing or coloring furs, wool, and hair skins, herein described and set forth, viz: by stretching them upon horizontal nettings, frames, or smooth surfaces of any suitable mate-

rial, and in this condition immersing the hair of the skins in dyes, either warm or cold, the object being to protect the skins from damage while the hair is acquiring the desired color."

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26. For an *Improvement in Tea Kettles;* Ezra Ripley, Troy, New York, March 14.

"This improvement consists in making that part of the spout which starts from the body of the kettle, to extend from the greatest diameter or bulge of the body up to within a short distance of the top, leaving only sufficient space between the top of the spout and the top of the kettle to give the necessary strength of metal, the sides of the spout being curved, so as to gradually run into the curve of the body of the kettle. By this form of the spout I am enabled to get the necessary area in the cross section of the spout to give the requisite strength to support a green sand core for the formation of the spout, so that the mould can be made in two parts, separated by a vertical plane passing through the middle of the body and spout. The two ears, to which the bale is affixed, are cast at the same time, one of these being a projection from the top of the spout. Another and important advantage arises from this mode of making tea kettles which cannot be attained by the old method, and that is, the glazing of the inside of the spout, to prevent the injurious action of oxidation."

Claim.—"What I claim as my invention and desire to secure by letters patent, is making the spout of tea kettles, at its junction with the body, to extend from the bulge of the body to within a short distance of the top, whereby, in moulding, the spout can be formed by means of a green, instead of a dry sand core, as herein described."

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27. For *Improvements in the Centrifugal Pump;* Wm. D. Andrews, New York, March 14.

These improvements are applied to the rotary pump that acts on the water by centrifugal force, and their nature will be clearly understood by reference to the

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the following parts, as applicable to the raising of water and other fluids, either alone or with an admixture of sand, gravel, or other substances. 1st. The vanes either straight and placed at right angles to each other, not radiating, but proceeding from the corners of an enlargement, increasing in depth as they approach the shaft,—or curved, proceeding from the centre, and increasing in depth as they approach the shaft. 2nd. The hollow cones inclosing the vanes and revolving with them. 3d. The joint formed by the fillet attached to the short pipe connected with the lower half of the revolving case, working within the stationary pipe attached to the outer case. 4th. The spiral passage of discharge constantly enlarging towards the exit."

28. For an *Improvement in the Stop-cock, or Faucet;* Thomas C. Clarke, Philadelphia, Pennsylvania, March 14.

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent is,—The introduction of a perforated valve, in combination with the main valve, for the purpose of more gradually stopping off the water, or other liquid, thereby preventing or lessening the liability of pipes bursting from the reaction of the stream when a strong head of water is too suddenly stopped off, as is the case in the common cock or faucet."

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29. For an *Improved Compound for Cements, and other purposes;* Wm. Yates and Dennis Dolan, Manchester, England, March 14.

The patentees say,—"The nature of our invention consists in the formation and compounding of a peculiar cement possessing the power of resisting fire and water, and also possessing a tenacity which renders it applicable to many useful purposes."

Claim.—"We claim as our discovery, or invention, 1st, the introduction of the tannin principle as an ingredient in our cement, as described; and 2nd, the mode of compounding such cement by pulverizing the portion containing the tannin principle, and the portion containing the gluten separate, and blending or mixing the two portions in a dry state, as described. We do not confine ourselves to the proportions mentioned, though we have found them to answer in practice for general purposes."

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30. For an *Improvement in the Horse Rake;* Seneca Ladd, Danville, Vermont, March 14.

The following extract, together with the claim, will enable those who are acquainted with the revolving horse rake generally used to understand the improvement.

"The object of making the beam to revolve, is to enable the person using the rake to discharge the hay or grain from it at any time, or to throw the teeth upward at any time and for any purpose. By simply elevating the upper end of the levers, the force of traction will cause the beam to revolve in its bearings, and thus throw the teeth upwards. As the beam revolves, the points of the auxiliary teeth will be brought into contact with the earth, and aid in completing the revolution of the beam."

Claim.—"I claim the above described mode of applying each of the teeth to the beam, or head of the rake, viz: by the joint spring and staple, in combination with each other, and acting together, as specified."

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31. For an *Improvement in the Horse Rake;* David Harkness, Raisin, Lenawee county, Michigan, March 14.

Claim.—"Having thus fully described the nature of my invention, in the manner of constructing the grain rake, what I claim as new

and desire to secure by letters patent, is the affixing of the rake-teeth, or fingers, in a shaft, or head, which is made to turn on gudgeons in suitable bearings in rear of the axle in such manner as to cause said axle to become a fulcrum for elevating the collected grain, the respective parts of the machine being arranged for that purpose, substantially in the manner or upon the principle herein fully made known."

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32. For an *Improved Method of Finishing Daguerreotype Miniatures;* Wm. A. Pratt, Alexandria, District of Columbia, March 14.

The patentee says,—"After having taken a picture according to the usual method, and having gilded it, I proceed, with varnish colors, (mixtures of different coloring substances with mastic or copal varnish,) to paint on the glass which is intended to cover the picture any design, such as clouds, plain black walls, curtains, chairs, couches, or any desirable accessaries; also, the working up the Daguerreotype itself to a degree of finish similar to oil painting, with the same colors; the laying the Daguerreotype on the glass, a complete juncture is formed, from the sticking or adhesion of the varnish color used; it is then submitted to pressure until perfectly dry, when I proceed, by the aid of nitric acid, to reduce or dissolve the copper backing to any desirable thickness; after this is done, any part of the picture may be cut away at the pleasure of the operator, and a new picture prepared as before attached."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method, above described, of joining two or more portraits, or portions of portraits, and the producing artificial background on the glass, which, from their nature, cement *themselves* and the *glass* on which they are painted to the pictures, and which also enables the operator to produce any size picture that his glass will allow, even with a small sized instrument, which last has many advantages which will in course of practice suggest themselves; the whole producing a beautiful enameled appearance, and perfectly protecting the delicate picture from contact with air or damp."

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33. For an *Improvement in Fan Blowers;* Isaac P. Smith, Orangetown, Rockland county, New York, March 14.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the various elements enumerated as entering into the construction and working of fan blowers, operated by auxiliary engines, for supplying the blast to the furnace of steam boilers; which elements consist of the increased diameter of the fan blower, and putting the fan directly on to the crank-shaft of the auxiliary engine; the combination of these two elements being essential to the end contemplated and attained by my improvement and invention, as above described."

34. For an *Improvement in the Abdominal Supporter;* Edwin K. Gale, New York city, March 14.

The patentee says,—"The nature of my invention consists in applying a supplemental spring to the lower edge of the pad, to cause the principal pressure to be made at that point, thus raising all the viscera by an upward and inward force, caused by the compound action of the body spring with the pad spring—combined in a simple, permanent, and efficient manner."

Claim.—" Having thus fully described my improvement, I wish it to be understood that I do not claim the combination of a pad spring with the body spring, this having been done in several trusses; but what I do claim as my invention and desire to secure by letters patent, is combining the body spring and pad spring, constructed as described, with the pad, substantially as herein described, so as to cause the pad, at its lower edge, to press inward and upward, while at the same time a freedom is given to adapt itself to all the motions of the body."

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35. For an *Improvement in the Rotary Centrifugal Pump;* Willis H. Johnson, Springfield, Illinois, March 21.

This pump consists of two or more disks on a vertical shaft, working in a case formed with a compartment for each disk, by rings that extend inwards to within such a distance of the shaft as to leave a passage for the water. The lower face of each disk is provided with radial, or curved ribs, or "paddle plates," and the under surface of the rings or partitions of each compartment is armed with radial partitions, or ribs. The ribs, or "paddle plates," by the rotation of the disks, act on the water and force it towards the periphery by centrifugal force, and then over the disk, towards the shaft. The same action then takes place at the next disk, and so on, until the water is discharged at the top.

Claim.—" What I claim as my invention and desire to secure by letters patent, is the combination of the circular revolving paddle plates with the cylindrical ring plates and radial partitions, constructed, arranged, and operated in the manner and for the purpose set forth."

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36. For an *Improved Ventilating Hat;* Richard Halloran, New York, March 21.

A section of a spring hoop is hinged, by its ends, to the inside of the hat, and near the rim, and the bow part is connected to the front of the hat by a slide, so that the hoop shall rest on the head, while the forward part of the hat is elevated by the slide, to permit the circulation of air. Or an entire hoop may be substituted, and connected with the hat by several slides.

Claim.—" What I claim as my invention and desire to secure by letters patent, is the forming of a ventilating hat, or other analogous

covering for the head, by means of hoops or bands, combined and operating substantially in the manner set forth."

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37. For an *Improvement in Lamps;* Samuel Rust, New York city, March 21.

This for an improvement in that kind of hand lamp in which a flat wick is moved up and down by a roller.

Claim.—"What I claim as new and useful in the lamp as above described, and desire to secure by letters patent, is the so bending or forming of the tube, and inserting it into the lamp, or stopper, as to place the edges of the tin, or material out of which the tube is made, on the centre or *middle part* of the *side*, and lengthwise of the tube opposite to the roller, so as to form a spring of the edges, or either of them, for the purpose of pressing the wick against the roller with a gentle pressure; and also I claim the projections, or narrow neck, or thin *space*, on the inside, and lengthwise of the tube in the centre or middle part of the wide, or flat side, (to be used either with the said edges which form the spring, as aforesaid, or to be used without,) combined with the roller in such way and manner, and for the purpose as above set forth, or in any other way that is substantially the same."

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38. For an *Improvement in Trusses;* Jacob Cooke and John Strickler, Strasburg, Virginia, March 11.

The patentees say,—"The nature of our invention consists in forming the pad in two parts, one of which is permanently affixed to the body spring, and the other, being jointed to the permanent part, is acted upon by a spring connected therewith, by which the local pressure is made much more effective."

Claim.—"Having thus fully described our improvement, what we claim as our invention and desire to secure by letters patent, is the combination of the pads, substantially in the manner and for the purpose set forth."

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39. For a *Combination of Matter for making Cream Nectar, or Vegetable Beer;* Simeon Whiton, Hartford, Connecticut, March 21.

The following are the ingredients and their proportions, viz:—ginger, 8 ounces; dried pumpkin, 4 pounds; pea nuts, or walnuts, 1 quart; sweet corn, 1 quart; cream tartar, 4 ounces; sugar, 10 pounds; essence of pipsissewa, 1 ounce; yeast, 6 gills; water, 20 gallons.

Claim.—"What I do claim as my invention and desire to secure by letters patent, is the combination of the four following ingredients, or either two of them, with the above, viz: cream tartar, pumpkin, nuts, and sweet corn, substantially as set forth in the specification, for the manufacture of vegetable transparent beer."

40. For an *Improvement in the Truss, or Abdominal Supporter;* Benjamin C. Everett, assignee of Benjamin W. Stratton, Philadelphia, Pennsylvania, March 21.

Claim.—"I do not claim the ratchet-hinge, as that has been before used, although under different arrangements. But what I do claim, is combining the ratchet-hinge with the truss pad and slide upon the flat spring, by which I gain the advantage of permanency of the pad and ease of adjustment."

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41. For an *Improvement in the Truss, or Abdominal Supporter:* David B. W. Hard, Bethlehem, Connecticut, March 21.

Claim.—"What I claim as my invention and desire to secure by letters patent, is in forming a frame to my support, which constitutes a narrow outer margin, and which, in the general outlines of the form given it, presents three sides, one side towards the right, one side towards the left, and one side towards the pelvis. And I further claim, in combination with said frame, the mode of effecting support of the abdomen by means of a strip of cloth, or other pliable material, extended transversely, and in front of its lower portion, above the pubis and between the bones of the ilium, said cloth being attached, at its right and left extremities, to the two lateral portions of the said frame, hereinbefore described."

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42. For an *Improvement in Windows;* James Ogden & Daniel R. Hart, Troy, New York, March 21.

Claim.—"Having fully described our improvements and their application, what we claim as our invention and desire to secure by letters patent, is constructing the windows of carriages in the manner described, having two or more divisions, or frames, with ledges at the top and bottom, so that by raising the lower frame all the others will be raised, in the manner and for the purpose set forth."

American Patents Re-issued in March, 1846.

1. For an *Improvement in the Running Gear of Carriages;* George Nichols, Trumbull, Connecticut, patent granted April 10, 1844, re-issued March 4, 1846.

The patentee says,—"The nature of my invention consists in affixing to the perch of a carriage (constructed of wood, steel, or other metal, of any convenient form,) two spring stay braces that extend from the spring bars, front and back, down to the centre of the perch, where they are so attached as to slide on the perch as the other end works up and down, which is effected either by bolts that pass through slots in the ends of the stay braces, by shackles, or any other method substantially the same."

Claim.—"I do not claim connecting the body of a carriage with the perch by means of longitudinal springs, as that has already been done;

but what I do claim as my invention and desire to secure by letters patent, is the combination of the spring stay braces with the perch, either by means of bolts passing through slots in the ends of said braces, in contact with the perch, or by any other analogous device, so as to allow the said braces to move thereon, substantially in the manner and for the purpose herein described."

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2. For an *Improvement in the Method of Driving Shuttles in Power Looms;* Robert P. Cunningham, Abington, Vermont, original patent granted April 25, 1843, re-issued March 14, 1846.

The patentee says:—"The object of my invention is to save, in part, the waste of power, and to arrest the shuttle at the end of its course without occasioning the jar experienced in the method heretofore practised, and which consists in so forming the cams that operate the shuttle levers as to give them a retrograde movement, which commences before the shuttle reaches the picker, and which gradually retards it, in accordance with the law of mechanics, by which the momentum of a moving body can be arrested with the least resistance, that part of the shuttle levers which the cams act on being retained in contact by a spring or springs, or by other means."

Claim.—"Having thus fully explained the principle or character of my invention, and indicated the various modes of applying the same, what I do claim as my invention and desire to secure by letters patent, is forming the picker cams, substantially as herein described, to give the pickers a retrograde movement, gradually, for the purpose of arresting the momentum of the shuttle at the end of its course, as herein fully described."

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3. For *Improvements in Machinery for Making Lead Pipe;* Benjamin, Jr., Henry B. & Geo. N. Tatham, of Philadelphia, Pennsylvania, assignees of John and Charles Hanson, of England; original patent granted March 29, 1841, re-issued March 14, 1846.

For an account of this patent, as originally granted, the reader is referred to page 346 of the 3rd volume, third series of this Journal.

Amended Claim.—"What we claim as our invention and desire to secure by letters patent, is the combination of the following parts, as described, to wit: the *core* and *bridge*, or *guide-piece*, with the *cylinder, the piston, the chamber*, and the *die*, when used to form pipes of *metal* under *heat* and *pressure*, in the manner set forth, or in any other manner substantially the same."

List of American Patents which issued in the month of April, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

(Continued from page 185.)

58. For a *Machine for Punching the Metallic Moulds of Buttons;* Alonzo C. Arnold, Norwalk, Connecticut, April 23.

The patentee says,—"The buttons to be formed consist of two circular plates of tin, or other metal. The outer one is flat, or convex, to suit the form of the button intended to be made, with a small rim round it, by turning its edge up at right angles. The other plate is for the back or inner part of the button, and is concave, having also a rim similar to the first, with a hole in the centre."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the entire combination, as described, of punches one within the other, operating in a die, as described, so as to produce the effect of cutting a circular piece of tin, of raising a rim round the edge, and of punching a hole in the centre when necessary, all by a single operation, which it has heretofore required three distinct operations to effect.

"I claim each and every part of said apparatus when combined, as above, to effect the above purpose. I do not claim the said combination, nor any part thereof, for any other purpose, except the punches, but I claim the outer and inner punches, operating in the same die, and the small punch which operates through the die, however they may be differently combined to effect said purpose."

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59. For an *Improvement in the Runner, or Upper Stone, of Mills;* Jos. H. Burrows, Cincinnati, Ohio, April 23.

Claim.—"I do not claim, as invented by me, the loading of a millstone with metal or other substance, or the use of a metallic eye, or bush for the same; but what I do claim as my invention and desire to secure by letters patent, is the manner of constructing the metallic plate, or back, in one solid piece, with its flanch or rim, which rim forms the upper band or hoop of the stone; and, also, of the manner of constructing the eye, or bush, so as to be of larger external diameter at its bottom than at its top, thereby forming a circular dovetail, to secure the stone in its place, in combination with the manner of securing the eye to the back by bolts, or otherwise, so as to form a firm and substantial stone; the whole being put together and combined in the manner substantially set forth."

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60. For an *Improvement in the Machine for Dressing Stone;* Theodore R. Timby, Auburn, New York, April 23.

In this machine, the block of stone to be dressed is placed on a permanent platform, and the sets of chisels, or cutters, are attached to a

reciprocating carriage by a double set of racks and their necessary appendages. The upper surface of the stone is dressed by cutters on the ends of spring trip levers, and the edges by side cutters.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the arrangement of the horizontal side cutters, in combination with the vertical cutters operated by the springs, and the spiral cams for raising them; and I also claim the arrangement of the vibrating rack and bar, in combination with the parallel racks for throwing the carriage in and out of gear."

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61. For an *Improved Tool for Beveling, Chamfering, and Howeling Barrels;* Samuel Widerman, Ellysville, Maryland, April 23.

This tool is formed like the common block plane used by coopers, and has an iron face plate of the same curve, and a bit for cutting the bevel. Along the outer edge of the face plate there is a flanch which runs on the outside of the barrel, and near the inner edge another flanch, provided with a bit to cut the chamfer, and to this flanch is secured a block that carries the howeling cutter.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the chamfering and howeling apparatus with the block plane, in the manner and for the purpose herein described."

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62. For an *Improvement in the Spring Seat Saddle;* Foster D. Ward, Bellbrook, Ohio, April 23.

The webs are attached to a spring at the pommel, and the jockeys, with the seat above, each rest on a spiral spring that projects upward from the saddle-tree.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the forward spring and jockey, detached from the forward part of the tree, with the spiral springs under the seat, in the manner and for the purpose described."

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63. For an *Improvement in Metal Roofs;* Wm. Beach, Philadelphia, Pennsylvania, April 23.

The plates are all fluted; one of the side edges of one plate is turned up, and over it laps the edge of the next plate, which is beaded for this purpose, and in this way all the plates forming one range are connected. The upper edge of the lowest range is turned up, to form a ledge, over which laps the turned down edge of the next range, and so on to the upper edge of the roof. And each plate is secured to the wood of the roof by a single nail, that passes through a hole in a protuberance made thereon.

Claim.—"Having thus fully described the nature of my improvements in the formation of a covering of cast iron for the roofs of buildings, what I claim therein as new, and desire to secure by letters patent, is the combination of plates whose surfaces are fluted, in the

manner set forth, in combination with the particular manner of joining them at their sides or edges, by the hollow bead and the respective ledges, formed as set forth; the whole being so arranged as that the surface of each plate will be on the same plane with its contiguous plates, laterally; and also, as making a part of the same combination, the manner of fastening the respective plates, by means of a single nail, or screw, passing through a hole in a protuberance made thereon, in the manner and for the purpose set forth. And I do hereby declare that I do not claim these devices otherwise than as they each make a part of this combination."

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64. For an *Improved Method of Regulating the Height of Water in Steam Boilers;* Charles Clinton, Goshen, Orange county, New York, April 29.

Above the boiler there are two horizontal cylinders, of different diameters, opening into each other, to which are fitted two pistons attached to one rod. The outer end of the larger cylinder communicates with the steam of the boiler, to make pressure on the piston, and thereby force water contained in the small one through a pipe which extends down nearly to the bottom of the boiler. In this pipe there is a valve governed by a float, so that, when the water in the boiler sinks below the required level, the valve is opened and the water forced down by the pressure of the steam on the steam piston, which, being larger than the water piston, will have the preponderance, and so soon as the water rises in the boiler to the required height, the valve is closed, and the supply arrested. Should the water sink too low, the steam piston is forced to the extent of its motion, and beyond a vertical pipe through which steam issues to give the alarm.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of a steam and water cylinder, provided with pistons connected together, with the boiler of a steam engine, having a float arranged within it, as set forth, so that, by the combined action of the cylinders and float, a continuous supply of water is afforded to the boiler, or an alarm given when it ceases, all as herein described."

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65. For an *Improvement in the Revolving Oven Cooking Stove;* Samuel B. Sexton, Baltimore, Maryland, April 29.

The oven used in this stove is a horizontal cylinder which turns in collars made in the end plates of the stove, the oven being provided with a circular rack, to admit of turning it at pleasure by a pinion and hand-winch. The outside flanch of the collars is of less diameter than the inner periphery of the oven, and to these are attached the oven shelf, bars, &c.

Claim.—"What I claim as my invention and which I desire to secure by letters patent, is the manner of supporting the revolving cylindrical oven on the circular collars; also, securing the ends of the shelf, rack, or bars, to the collars, as described."

66. For an *Improvement in the Spark Arrester;* A. Keagy & M. Shiner, Jr., Woodbury, Pennsylvania, April 29.

Claim.—"Having thus fully described the manner in which we construct our improved spark arrester, and likewise shown the operation thereof, we do hereby declare that we do not make any claim to either of the parts which we have described, taken individually, the whole of them having been used, under various modifications, in other instruments for the same purpose; but what we do claim, as constituting our invention, and desire to secure by letters patent, is the particular manner in which we have combined and arranged these parts, as set forth; that is to say, we claim, in combination, the employment of the perforated cone, and of the perforated zone through the outer case, the said cone and outer case being connected together by the curved rim; the upper end of the chimney terminating in the region of the perforated zone, and this zone being surrounded by a rim; the whole combination and arrangement being substantially the same with that set forth and made known."

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67. For an *Improvement in Liquor Cocks;* Charles A. Creasey, Philadelphia, Pennsylvania, April 29.

Claim.—"What I claim as a new manufacture in the above described cock, is the making it in part of cast iron, and in part of brass, in the manner set forth; that is to say, by casting the body, and also the key or plug, of iron, and then lining the socket, and covering the conical part of the key, with ferules of brass, or of some analogous metal; as fully set forth and made known."

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68. For an *Improvement in the Apparatus for Measuring and Cutting Garments;* Hiram Leger, Macon, Georgia, April 29.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the making and using of an 'apparatus (consisting of a combination of scales and the spirit-level,) for measuring and cutting garments,' as described."

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69. For an *Improvement in the Method of Making Sugar Moulds;* Antoine Carbonel, Philadelphia, Pennsylvania, April 29.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described mode of making sugar moulds, by giving to the cast iron lining mould a simultaneous vertical and horizontal movement over the cone, or core, for forming the cavity or interior of the article to be moulded, whilst the core or cone itself has a simultaneous horizontal movement.

"I likewise claim the mode of moulding sugar moulds by covering the core and the lining of the mould with paper, linen, or other material, to prevent the clay from adhering to them, as set forth."

70. For an *Improvement in the Bee Hive;* J. Milholland and B. Crane, Chandlersville, Ohio, April 29.

Claim.—"What we claim as our invention, and which we desire to secure by letters patent, is the construction and manner of using the boxes composing the bee house, as described."

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71. For an *Improvement in the Cork, or Bottle Stopper;* Nath. D. Whitin, New York, April 29.

Claim.—"What I claim as my invention and wish to secure by letters patent, is the construction of the cork, or bottle stopper, in combination with a faucet, or stop-cock, for the purpose of forming a sort of imperishable cork, or stopper, by means of which, aerated fluids, such as porter, soda water, mead, small beer, &c., may be discharged in such quantities as may be desired, without the escape of the gas and consequent deterioration of the remaining contents of the bottle, or the removal and destruction of the cork, it being intended to refill the bottle through the stop-cock; in bottling soda water, the combined cock will be particularly useful in obviating the difficulty of stopping the bottle before too much gas escapes."

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72. For *Improvements in the Percussion Lock for Cannon;* Enoch Hidden, of New York, and Samuel Sawyer, of Boston, Massachusetts, April 29.

The cock, instead of simply turning on the fulcrum pin, as in other locks, has an elongated hole, through which the pin passes, the cord by which it is operated being attached to the under side of the cock and passed around rollers, so that when the cord is drawn with a jerk, the cock, the moment it strikes the cap on the nipple, is drawn back from the touch-hole. The cock is adjustable, with reference to the touch-hole, by means of a set screw and projection on the body of the lock. The pad, or vent-stopper, is attached to the end of a spring that swivels on the lock.

Claim.—"What we claim as our invention and desire to secure by letters patent, is:—

"1st. Causing the cock, or hammer, to strike over the vent and instantly to recede therefrom, by means of the chase mortise in the cock, and the cord being suddenly jerked by the person firing the gun, in the manner before described, or in any other mode or method substantially the same.

"2d. The method of adjusting the cock to the vent, by means of the screw or projection on the body of the lock, as described.

"3d. The mode of fastening the lock to a gun that has no vent-field, by means of the pin, screw, and pins, as described.

"4th. The construction and arrangement of the vent-stopper, as described."

73. For an *Improvement in Piano Fortes;* Charles Bossert & John Schomacker, Philadelphia, Pennsylvania, April 29.

Claim.—"What we claim as our invention and desire to secure by letters patent, is the construction and arrangement of the hammer, so as to admit the lifter into the block, and act at a point on a line with its fulcrum, and its combination with the grand action, as described. We also claim the bridge, elevated above the pin block, in the manner and for the purpose described. We also claim, in combination therewith, the metallic bar having on it the projections, for the purpose set forth. We further claim the hinged hammer beam, or rail, combined and arranged as described."

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74. For an *Improvement in Stop-cocks;* Uel West & George Dobbs, New York, April 29.

The case of this stop-cock is conical, to which is fitted the key of the same form, having the water passages in it. The supply pipe is connected with the base of the cone at such an angle as to be in a line with the discharge pipe that is attached to the conical surface.

Claim.—"What the undersigned claim as their invention, is the combination of the two conical hollow cylinders, fitted together in the manner described, so as to form a perfect stop-cock, admitting the fluid at the base through its receiving pipe, and discharging it at its side through its escape pipe, or to be stopped and become water-tight, by turning the key, or inside cone."

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75. For *Improvements in the Cut-off Valves of Steam Engines;* Horatio Allen, New York, April 30.

Claim.—"1st. The combination of two slide valves, having their simultaneous motions in opposite directions, with a single movable seat containing two openings, leading respectively to opposite ends of the cylinder, as described. 2nd. The combination of the levers, or beams, which give simultaneous motions in opposite directions to two cut-off valves, with a rock shaft, or shafts, having bearings on movable supports; said valves being any valves which are at liberty to pass over or into the openings which they are intended to close, and said supports of rock shaft being such that they can readily be raised or depressed at pleasure, in the directions of the alternating motions of the valves, without interrupting their movements."

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76. For an *Improvement in Propelling Boats;* Philip C. Traver, Rhinebeck Flats, New York, April 30.

Claim.—"What I claim, and desire to secure by letters patent, is applying the water lifted, or thrown up, by the paddle wheels of steamboats so as to produce an auxiliary propelling power, in the manner described, or any analogous thereto."

77. For an *Improvement in Reaction Water Wheels;* Samuel B. Howd, Lyons, New York, April 30.

Claim.—"What I claim, and desire to secure by letters patent, is a mode of constructing a water wheel, commonly called a reaction wheel, by elevating it upon raisers placed between the disk of the wheel and the lower rim thereof, for the purpose of raising the upper surface of the lower rim to a level with the upper surface of the bottom of the cistern within the wheel, and for the further purpose of affording a channel of escape for the waste water rushing between the wheel and cistern, in the manner and for the purpose described."

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78. For an *Improved Mode of Making Candles;* Ebenezer Marsh, Alton, Illinois, April 30.

The patentee says,—"The nature of my invention and manner of operating is as follows: About six ounces (the precise amount not material,) of strong nitric acid is added to a gallon of castor oil, and the same thoroughly mixed by stirring them together several times for the first twenty-four hours, then letting the same stand for six or eight days, or until it becomes sufficiently hard; or the process may be expedited by beating and stirring the same together when first mixed, and suffering it to stand until it becomes sufficiently hard. It is then shaved up fine and washed with water slightly alkaline."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the process, herein described, of hardening expressed vegetable oils by acids, for the purpose of making candles."

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a Patent granted to James Laming, *of the city of London, for an invention of improvements in making the cyanides and ferrocyanides of Potassium and Sodium,—being a communication from abroad.*—[Sealed, 18th November, 1845.]

The patentee, before describing the invention as communicated to him from abroad, has, for the better understanding of the improvements, detailed the chemical facts or principles upon which they are founded; these are as follow:—

1st. When animal matter, which contains nitrogen, as well as hydrogen and carbon, is exposed to a high temperature, not exceeding low red, an equivalent of nitrogen combines with three equivalents of hydrogen to form an equivalent of ammonia, and the carbon is separated.

2nd. When ammonia is exposed to carbon at a full red heat, an equivalent of ammonia exchanges two of its equivalents of hydrogen for two equivalents of carbon, and thus becomes prussic or hydrocyanic acid.

3rd. If free potassium or sodium be also present, the equivalent of ammonia parts with all its three equivalents of hydrogen, and the nitrogen which remains takes in their place two equivalents of carbon to form cyanogen, and one equivalent of potassium or sodium, as the case may be, to form a cyanide of the metallic base.

4th. When animal matter is exposed to heat, its temperature becomes gradually increased to low redness before it assumes that higher temperature indicated by a full red color; therefore, whenever animal matter is subjected to what is called destructive distillation, the formation of ammonia must take precedence, in point of time, to that of prussic acid or of the cyanides.

5th. When the oxide of potassium, or of sodium, or the carbonate of either of those oxides, is intimately mixed with carbon, and exposed to a heat approaching to whiteness, its metallic base is set free from the oxygen with which it was previously combined, and rises in vapor. If ammonia comes into contact with the mixture of carbon and alkali, or of carbon and alkaline carbonate, the separation of the metallic base from its oxygen takes place at a lower temperature,—under such circumstances, a full red heat being sufficient. In the case of the carbonates, the metallic bases, potassium and sodium, are liberated from the carbonic acid also, whenever they separate from their oxygen.

6th. Cyanide of potassium, or cyanide of sodium, by exchanging an equivalent of every three equivalents of its base for an equivalent of iron, is converted into the corresponding ferrocyanide, or what is called in commerce prussiate of potash, or prussiate of soda; and this change may be effected by causing the cyanides of the respective metals, dissolved in water, to come into contact with iron, or oxide of iron, in a state of division.

The ordinary way of combining potassium or sodium with cyanogen, preparatory to making the prussiate of potash, or prussiate of soda, for commerce, is to expose, in iron pots, an impure carbonate of one of those alkalies and animal matter to a red heat, and to trust for the necessary contact of the nitrogen and carbon of the animal matter with the metallic element, to the thorough incorporation of the ingredients of the pasty mass by stirring. While the temperature of the animal matter is approaching redness, ammonia is constantly being generated, and as it is volatile, it escapes and is lost; and this continues until the heat becomes great enough to convert the nitrogen and carbon of the animal matter into cyanogen, and to fix that cyanogen, by combining it with the metallic base of the alkali. Another source of loss is, the difficulty of causing the different elements contained in the pasty mass to combine; for, before each can be brought into contact with the other, by mechanical agitation, their temperature becomes elevated, and great part of the resulting nitrogenous gases, which are volatile, have time to escape. There is a third evil attending the ordinary process, namely, the proportion of carbon in animal matter, compared to its nitrogen, is greater than that in the alkaline cyanides; the greater part of this carbon, from its fixed nature, remains to solidify the mass from which the nitrogen so freely escapes;

so that it becomes necessary to suspend the addition of the animal matter, on account of the mass being too solid for the chemical action to go on, before enough of nitrogen has been combined to convert much of the alkali into prussiate.

Two patents have already been granted for methods of preventing the losses sustained in the ordinary way of making the prussiates of potash and soda. By one of these methods, the ammonia which is liberated from a heated mixture of alkali and animal matter, is conducted first over the surface of fused alkali, (the said alkali having no admixture of carbon,) and afterwards into a vessel containing a solution of alkali. The other of these methods directs that the ammonia, which results from animal matter exposed to heat, be made to pass upwards and downwards through a series of vertical pipes, arranged on the principle of inverted syphons, heated to redness, and charged with a mixture of charcoal, potash, and iron, reduced to small fragments. With regard to the former of these methods, it is well known to chemists that fused alkali has no power of decomposing ammonia into cyanogen unless carbon be present; and with regard to the latter method, it is obvious that, as the materials, if brought into a state of fluidity or pastiness, must, of necessity, choke the passage of the pipes, the method demands that the mixture in the inverted syphons be kept from losing its solid or granular state; and the continuance of that state is secured by the large proportion of infusible charcoal compared to the fusible potash, which the patentee prescribes, as fulfilling his intentions in a satisfactory manner.

Now, under the present invention, the patentee makes use of charcoal, or other form of carbon, in powder, mixed with one of the alkalies, or its carbonate or other salt, capable, under the circumstances, of surrendering its metallic base to cyanogen. This mixture is constantly maintained in a fused state, so as to be fluid, or at least in a pasty condition, which is highly favorable for converting the metallic base of the alkali, or its salt, into a cyanide, and which takes place rapidly under such circumstances, when a current of ammonia gas is introduced to the fused mixture. The metallic base of potash, or soda, or of their compounds respectively, as the case may be, is liberated by the agency of the heated carbon, assisted by the affinity of the metallic base for the cyanogen, which is at the same time formed by the combination of heated carbon with the nitrogen of the ammonia; cyanide of the metallic base is thus produced, and this product is constantly augmented in quantity (the current of ammonia being continued) until great part of the alkali, or other compound of its base, has become converted into cyanide. When an alkaline carbonate is used, powdered charcoal, to the amount of more than 30 per cent. of its weight, may be added, without destroying the fluidity of the mixture if the temperature is raised to a full red. When the potash or soda is in a caustic state, a larger proportion of charcoal may be added; or, what is more advantageous, the mixture will remain fluid, although the heat be raised not so high. Whether the ammonia gas is passed through the mixture of carbon and fused alkali, or other compound of its metallic base, (which is preferred,) or over its surface, it is better

to have more than one vessel charged with the heated materials, and so connected together by pipes, that the nitrogen of the ammonia, which escapes the chemical reaction in the first vessel, shall not pass through the whole series without combining. The apparatus thus acts on the principle of a series of Woolfe's bottles, and according to this invention all the vessels are made red hot, except the last, into which water, or some liquid convenient for arresting the vapors of alkaline metal, is put; or otherwise the vapors might be lost. The first product, as in the common process for making prussiate, is a cyanide of the alkaline metal present, which may be dissolved out from the mass, technically called "metal," by boiling the latter in alcohol, of about 0·896 specific gravity, from which, filtered hot, it spontaneously separates, in great part, on cooling. To obtain the ferrocyanide, the metal is to be treated in the usual way, namely, its soluble parts dissolved in water, then treated with iron, the solution evaporated, and, when sufficiently concentrated and clear, set aside to crystalize; and the rough product is afterwards purified by re-crystalization.

The patentee states that he does not claim the invention of any process for dissolving out or obtaining either cyanide or ferrocyanide from the compound termed "metal;" nor does he claim the construction of apparatus wherewith the process or processes may be carried on; but he describes some arrangements which have been found to answer. One of these consists of three iron air-tight covered pots, communicating with one another in the manner of ordinary Woolfe's bottles: that is to say, the induction pipe of the first pot reaches to near its bottom,—its eduction-pipe reaches down the interior of the second pot to near its bottom,—and the eduction-pipe of this second pot terminates in like manner in the third pot; while the eduction-pipe of the latter plunges beneath the surface of some water, or other liquid, convenient for oxidizing and arresting vapors of alkaline metal. Each of the pots has a man-hole in its cover, by means of which it may be charged and discharged, and a door, by which it may be perfectly closed. Each covered pot is so set in a furnace as to be heated to a temperature great enough to keep its contents in a state of constant fusion. Its charge, when fused, should about half fill it. By the use of this apparatus, the ammonia which is forced into the first pot, by reason of its own elasticity under the pressure attending its assumption of the gaseous state, passes through the fluid mixture of fused alkali and carbon in that pot,—being there decomposed into nitrogen or cyanogen, and, as cyanogen, combining with and saturating the alkaline metal present; after which the ammonia or its nitrogen or uncombined cyanogen, which results from its action on the carbon, still remaining in that pot, passes into the second pot, to convert the alkaline metal there present, into a cyanide. In like manner, the ammonia, or its nitrogen, or the resulting cyanogen, may arrive in the third pot; then is the time for stopping the operation, in order that the two first pots may be emptied and re-charged. Owing to the volatility of the alkaline metals at high temperatures, the pipes of communication between the pots are apt to become obstructed; for this reason they are proposed to be made straight, and joined together at

right angles, in such a manner that by removing a screw-plug from the end of each rectilinear piece, the passage through it may be cleared by passing into it a short rod of iron; in order that this process need not be often repeated, the diameter of the pipes should be as great as convenience admits of.

The patentee next describes a modification of the preceding apparatus, wherein no pressure is required to overcome the resistance opposed to the current of ammonia by the fluid mass into which the induction-pipes of the preceding apparatus are immersed. In this modification all the induction-pipes stop short at the covers of the pots, except that of the open pot, which may be allowed, without much inconvenience, to dip below the surface of the water, or other liquid, intended to arrest the metallic vapors.

The ammonia gas, in this case, urged forward by an inconsiderable amount of pressure, comes into contact with the surfaces of the fused ingredients in the several pots in succession, until it is either decomposed and its nitrogen absorbed, as in the preceding case, or escapes by the last eduction-pipe of the series; to prevent which, either the number of pots may be increased, or, what is better, each of the three should be furnished with agitators, moved by machinery or labor. When the latter arrangement is adopted, each pot should be furnished with a lofty conical cover, containing, at its apex, a stuffing-box, in which the axis of the agitator turns, and which is kept sufficiently cool by a stream of water running through a small cistern, which embraces the stuffing-box. With this apparatus, the fused ingredients may be either in a fluid, semi-fluid, or pasty condition.

The patentee claims the making of the cyanides and ferrocyanides of potassium and sodium; or, as they are called in commerce, prussiates of potash and soda, in any suitable apparatus, by passing ammonia (either pure, or mixed with such other gases as do not prevent the desired result,) over the surface, or through the mass (according as the induction-pipes may dip or not below the surface) of potash, or soda, or other compound of potassium or sodium, (capable, under the circumstances, of setting free its metallic base,) in a state of fusion by heat, and mixed with charcoal, or other form of carbon, in powder, and in such proportion as to be adequate to effect, without destroying by its bulk, the fluid, semi-fluid, or pasty condition of the resulting mass. And, further, he claims, for the process or processes of this invention, the sole use of ammonia, or mixture, or combination of ammonia with other gases or vapors, whatever be the source from which it is obtained; provided, always, that in such mixture or compound there be no substance present capable, by its nature, of preventing the desired result. He claims, for example: the application to this invention of ammonia, or carbonate of ammonia, obtained from gas-water, from urine, from the liquor condensed in the distillation of bones or other animal matter, or from one or other of the salts of ammonia, or a solution of ammonia; and also the ammonia, or carbonate of ammonia, which is obtained directly, mixed with other gases, in the carbonization of bones and other animal matters, and in the chemical treatment of guano. Whatever be the source from whence the

ammonia is obtained, it is desirable that it should be made as free from the vapor of water as possible before it is introduced to the fused materials; for this purpose the substances from which it is to be eliminated may be dried, or else the ammonia may be passed, in an elastic state, in contact with some substance known to chemists to be convenient for desiccating that gas.

Instead of obtaining the ammonia by a separate process, or from a distinct vessel, the inventor sometimes causes it to be given off from animal matter contained in the vessel or vessels in which the cyanide is formed. For this purpose it is better to use the potash or the soda in a caustic state, causing it, while in that condition, to dissolve the animal matter. The following is the mode of proceeding:—A caustic solution of alkali, in water, or other convenient liquid, is first made boiling hot, and to it, while boiling, as much animal matter is added as it will readily dissolve; the solution is next evaporated to dryness, and the mass preserved in that state for use. When a portion of this mass is put into each of the heated vessels, except the last, of such a series as has been described, and the last heated vessel is charged with carbon, mixed with some convenient compound of an alkaline metal, as before stated, then the ammonia which escapes from any one of the vessels in the series, will have to pass through one or more subsequent vessels, and thus tend to suffer decomposition; the resulting nitrogen being converted into cyanogen, and then being absorbed. This admits of the cheaper kinds of animal matter being used,—such as the undried flesh and viscera of carrion, and old woolen flock and rags, which, by reason either of humidity, or too great volume, cannot conveniently be mixed in their natural state with red hot alkali. The patentee claims this modification of the process as part of the invention for which this patent has been granted. Sometimes the mass resulting from the desiccation of the solution of animal matter in caustic alkali is put into red hot open pots; in this case, much ammonia is lost, but the improvement which is introduced by replacing the ordinary mechanical admixture by an intimate chemical combination, affords a greater product in prussiate than can be obtained from an equal quantity of animal matter treated in the ordinary way.—[*Inrolled, May*, 1846.]

Lond. Jour. Arts & Sci.

Specification of a Patent granted to WILLIAM GREENER, *of Birmingham, and* WILLIAM EDWARDS STAITE, *of the county of Surrey, for improved means of ignition and illumination.*—[Sealed, 7th February, 1846.]

This invention consists in obtaining light by means of solid prisms or cylinders of carbon enclosed in air-tight vessels of glass or other transparent substance, which prisms, when acted on by currents of voltaic or magnetic electricity, are rendered luminous; (the carbon being previously freed from impurities, and divided on the surface into numerous acute points;) or rods or strips of platinum, or other metal

not easily fused, when divided on the surface into numerous acute points, and enclosed in transparent air-tight vessels, may be employed, together with currents of electricity, for producing illumination. The invention also includes the employment of hollow cylinders of carbon, either plain or acuminated, partially inserted within, and brought into perfect contact with hollow cones of platinum, either plain or acuminated; the whole, being enclosed in transparent air-tight vessels, are rendered luminous by electric currents.

Carbon and platinum have been before used for the above purpose; but the patentees state that carbon has been found to give out various extraneous matters, which interfere with the continuity of the light, and darken the glass vessel by deposits on the inside of the same; and from plain surfaced platinum only a feeble light has been obtained. In order to obtain carbon perfectly pure, or as nearly so as possible, the patentees digest a quantity of lamp-black, or pulverized charcoal, or pulverized coke, (which has been purified from sulphur and other matters by the application of electricity, according to the method patented by J. Church, December 20, 1845,) in dilute nitro-muriatic or other acid; it is then strained from the acid, and washed several times in water; it is next washed in a weak alkaline solution; and, lastly, in distilled water, until no traces of impurity are perceptible. The purified carbon is thoroughly dried, and then converted into prisms or cylinders by means of an hydraulic or screw-press, in the same way as the porcelain buttons are made; and sometimes, to insure perfect dryness and homogeneousness, the prisms or cylinders are exposed to an intense heat in a furnace for about twenty-four hours. The numerous acute points are formed on the surfaces of the prisms or cylinders by means of a saw, or by casting them in suitably-indented disks. The advantage obtained by opposing two such acuminated surfaces, the one to the other, is, that should the electric current cease between any two points, (as frequently happens in the ordinary mode of igniting carbon by electricity, when there are only two points in opposition,) the current will be kept up by the remaining points, and the light maintained without any material interruption or abatement. In some cases a number of thin strips of charcoal, separated from each other by platinum foil, and bound together with platinum wire, are substituted for the bodies with acuminated surfaces; and sometimes, instead of employing either lamp-black, charcoal, or coke, plumbago or black-lead is prepared, formed, and used in the same way.

When platinum, or other difficultly fusible metal, is used as the illuminating medium, the number of separate points on its surface are multiplied as much as can be conveniently effected; and, for this purpose, the patentees either perforate a sheet of the metal with a great number of minute holes, or take it in the form of wire, and weave it into a gauze sufficiently thick to bear the heat produced by the electric current without fusing. When hollow cylinders of carbon are employed in combination with hollow cones of platinum, they are arranged in the following manner:—The two wires from a voltaic battery are each connected with a hollow cone of platinum, either plain or acuminated, and the cones are placed with their bases facing,

but at a short distance from each other; the cones are then connected by placing between them a hollow cylinder of carbon, either plain or acuminated, and inserting it so far into them as to be in perfect contact therewith all round. Such cones and cylinders may be used either in single sets, or in any number of sets which the battery or batteries employed, may be adequate to supply. When the illuminating medium is placed in the transparent air-tight vessel, it may be either kept stationary or made to rotate.

The patentees claim, Firstly,—the employment, as a medium for the development and exhibition of electric light, of carbon, purified and prepared as above described. Secondly,—the employment, for the said purpose, of carbon and platinum, or any other like difficultly fusible metal, in solid prisms or cylinders, divided on the surfaces thereof into numerous acute points, or in such other forms as to present numerous acute points, as above described. Thirdly,—the employment, for the said purpose, of hollow cylinders of carbon, either plain or acuminated, in combination with hollow cones of platinum, or other like difficultly fusible metal, either plain or acuminated, as above described.—[*Inrolled, August*, 1846.] Ibid.

Specification of a Patent granted to Timothy Kenrick, *of the county of Stafford, iron-founder, for improvements in glazing and enameling the surfaces of cast iron.*—[Sealed 26th May, 1846.]

This invention consists in enameling the surfaces of certain cast iron articles. The vessel of cast-iron required to be glazed and enameled, must first be well cleaned; it is then ready for the application of the enamel, which is composed of two coats, one forming the body, and the other producing the glaze. The first composition is made by fusing 100 lbs. of calcined flints, ground to fine powder, with 75 lbs. of finely pulverized borax, and then grinding 40 lbs. of this mixture with 5 lbs. of potters' clay, in water, until it is brought to such a consistence that, when the cast iron vessel is dipped into the composition, it will receive a coating about one-sixteenth of an inch thick. As soon as the coating, thus applied, has become set, and while it is yet moist, the second composition, which is in a finely pulverized state, is sifted over it. The second composition is formed by mixing together 100 lbs. of Cornish stone, ground to a fine powder, 117 lbs. of finely ground borax, 35 lbs. of soda-ash, 35 lbs. of saltpetre, 35 lbs. of sifted slaked lime, 13 lbs. of white sand, and 50 lbs. of well-pounded white glass, and vitrifying the mixture; when cool, it is ground very fine in water, and afterwards dried; 45 lbs. of the powder and 1 lb. of soda-ash are well mixed in hot water, by stirring; and the mixture being then dried in a stove, a fine powder is produced, which constitutes the second composition. When this powder has been very evenly sifted over the first composition, the cast iron article must be put into a stove kept at a temperature of about 212° Fahr., in order to dry the composition; after which, the composition is fired, by placing the article in a kiln or muffle, kept at the temperature requisite to fuse the glaze. If the article is found to

be imperfectly glazed, when withdrawn from the kiln, some of the glazing composition is again sifted over it, and it is replaced in the kiln until the glaze is fused.

For coating the inside of iron pipes, over which the glaze-powder cannot be conveniently sifted, on account of their length or small diameter, the patentee proceeds in the following manner:—When the inside of the pipe has been cleaned, he pours the first composition through it, turning the pipe round at the same time, to insure an even coating upon every part; after this has become set, he pours the second composition through in a similar manner, and then fires it in a kiln, as above mentioned.

The patentee, in concluding his specification, says, that the interior surfaces and rims of cast iron vessels have been heretofore enameled and glazed by the application of two-coatings, one for the body, and the other for the glaze. He therefore claims, Firstly,—the enameling and glazing, in the manner above described, of the exterior surfaces only of such vessels of cast iron. Secondly,—he claims the enameling and glazing of cast Italian-irons, cast box-irons, and cast iron knobs for doors and other purposes. Thirdly,—the enameling and glazing of the inside of such cast iron pipes as aforesaid. And, Lastly,—the enamel and glazing of the ornamental surfaces of cast iron.—[*Inrolled, November*, 1846.] Ibid.

FRANKLIN INSTITUTE.

Committee on Science and the Arts.

Report on Apparatus for Double Seaming Tin-ware, &c.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred, for examination, a Machine for Double Seaming Tin-ware, &c., invented by Mr. George R. Moore, of Philadelphia, Pennsylvania, Report:—

That, upon examining the machine, they find it simple in its construction, and in many respects similar to those used for swedging and burring.

The most essential points wherein it differs from other double seaming machines, consist in the peculiar form of the heads, or dies, combined with a small roller running at an angle of about 45 degrees with them, for the purpose of keeping the work in its place during the operation of turning down the seam.

Also a sliding gauge, for holding in a proper position any flaring article, all of which are fully explained in the drawing and specification herewith submitted.

These features embrace all that is claimed by Mr. Moore, as new, and for which he has obtained letters patent.

The committee have devoted considerable time and attention to ascertain, as correctly as possible, the practical working of the machine, and for that purpose had it tried by different workmen, and the result,

in every instance, was entirely satisfactory; and, in addition to their own observation, they have been favored with the testimony of several highly respectable manufacturers, in whose establishments they are now successfully used.

These facts induce the committee to recommend the machine to the favorable notice of manufacturers of tin-ware.

By order of the Committee,

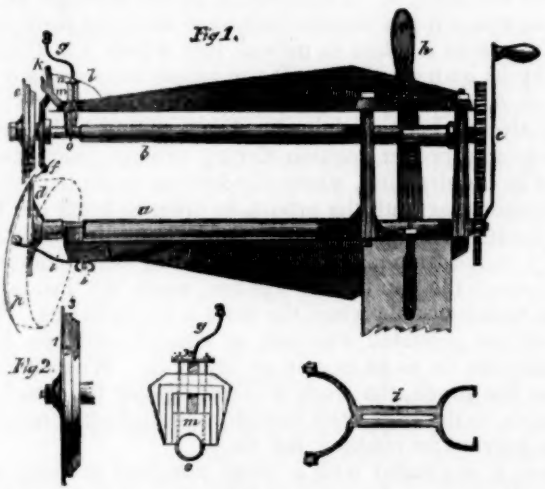
WILLIAM HAMILTON, Actuary.

Philadelphia, March 11, 1847.

Description (extracted from the letters patent) of a Double Seaming Machine, invented by GEO. R. MOORE, *of Philadelphia, Pennsylvania, dated September* 19*th*, 1846.

Reference is had to the accompanying drawing, which presents a front view, and makes a part of this description.

All the parts that are not lettered compose the frame simply, the construction of which is obvious from the drawing, as it is similar to other tin machines, and made of the same materials; it may, however, be varied.



I proceed to describe the working machinery, noticing first the two arbors, *a*, and *b*, which are connected by cog wheels, and turned by the crank, *c*. Two heads, *d*, and *e*, are affixed to the ends of these arbors, and between these heads the double seaming is performed. A pan, *p*, is represented in dotted lines, as placed over the head, *d*, on the lower arbor, so as to bring the edge which is to be seamed down between the head, *e*, and a small roller, *f*, hereafter described. The shape of the head, *e*, should be carefully noticed. This head consists of a flanch, 1, projecting from a cylindrical surface, 2, similar to some other machines now in use; this cylindrical surface is terminated

by a shoulder, 3, that connects with a conical moulding, 4. The bevel surface of the head, *e*, bears first upon the edge of the pan, which is sustained by the head, *d*, the shoulder, 3, above named, coming against the bottom, and the edge is forced to yield to the bevel of the head, *e*, as this is screwed down upon it by means of the screw, *g*, and should any part of the edge be inclined to slip out towards the top of the pan, (as this edge is always composed of three thicknesses,) it is prevented from so doing by the little roller, *f*, attached to the collar, *k*, that surrounds the arbor, *b*, near the head.

At this stage of the operation, the crank, *c*, is turned, the pan revolves in the machine, and the edge is turned down as far as the bevel part, 4, of *e*, will turn it, while the shoulder, 3, prevents the edge of the pan from bending too far down towards the centre; after this, the head, *e*, must be raised up a little by turning the screw, *g*, attached to the box, (in which the arbor, *b*, runs,) and then the lever, *h*, is brought into use, to move the arbor, *b*, inwards, by which the cylindrical part, 2, of the head, *e*, which is parallel with the outer surface of the head, *d*, is brought over the same and then screwed down towards it, by the screw, *g*, when, by again turning the crank, the work is completed. The outside shoulder, 1, of the head, *e*, keeps the bottom of the pan close against the head, *d*. The lever, *h*, passes through an aperture in the frame, where it has room to be moved back and forth, and places are fitted to receive it when so moved, into which it is thrown by a spring, or by its own elasticity. It also passes between two shoulders on the arbor, *b*, and its lower end is connected to the frame by a pivot. Its use has already been explained. *i*, is a sliding gauge for the purpose of holding in proper position flaring articles, such as the pan represented in the drawing, where the bottom needs to be thrown out from a perpendicular with the arbors, in order to bring the body parallel with them. This gauge consists of a shank that is attached, by the screw, *j*, to the frame, and is terminated by heads branching out for the bottom of the pan to rest against, upon the inside. This is found to be indispensable when the work is much flaring. The heads of this gauge are provided with soft or smooth surfaces, to prevent them rubbing the tin so as to mar or injure it. When it is not desirable to use the gauge, the work will rest against the head, *d*, which is faced nearly to the edge with leather, although other materials may be used, to prevent its rubbing the tin.

The piece, *k*, is a collar with a lever attached thereto, the collar part of it is fitted upon the arbor, *b*, allowing the arbor to turn freely in it, while the upper end passes through a loop, *m*, in the frame, to keep it in an upright position, and below the collar, this lever passes through the little roller, *f*. The only use of the loop, *m*, is to bring the roller, *f*, to bear properly upon the work, and to secure this the better, the lever, *k*, is made crooked at the top, so that, by pressing it down, this part of it is brought towards the frame, and consequently the roller, *f*, is moved up closer towards *e*, and *vice versa*.

A spring, *l*, is applied to throw *k* back, as it rises up, to make it easy to get the work properly into the machine.

The screw, *g*, is so connected with the arbor, *b*, by means of a bow and yoke, that both are raised or lowered at pleasure.

What I claim in this invention is the combination of the roller, *f*, with the head, *e*, constructed and arranged substantially in the manner and for the purpose set forth.

I further claim the combination and arrangement of the gauge, *i*, in the manner and for the purpose heretofore described, supporting the inside of the vessel at the bottom while being operated upon, when the sides thereof are flaring.

And lastly, I claim the employment of the shoulder, 3, which terminates the base of the conical part of the head, *e*, to keep the bottom in place while making the first bend, as above described.

Report on a Wicket-gate for Canal Locks.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the plans and model of a Wicket-gate for Canal Locks, invented by F. C. Lowthorp, Esq., C. E., of Pennsylvania, REPORT:—

That they have examined the plans and models of Mr. Lowthorp, and have had the benefit of his personal explanations.

They submit herewith a drawing of the apparatus, and a description furnished by the inventor, which refers, by letters, to the different parts of the drawing. There is also in the possession of the Institute the original working model, constructed by Mr. Lowthorp, on a scale of one inch to a foot, which was tested at Mauch Chunk, where it was attached to the fore-bay of a mill that furnished a constant head and an abundant supply of water for the experiments, which are said to have been very successful. The committee experimented with a small brass model, somewhat differently arranged, which was intended for the Patent Office, at Washington. In it the top and one side were made of plate glass, so as to exhibit clearly the interior arrangements and movements of the parts. It was attached to a reservoir four feet deep, filled from a hydrant. It worked very satisfactorily, the large wicket being under perfect command, and being capable of being set in motion or stopped at any angle desired, without causing any shock.

The object of the apparatus is to draw water rapidly from a higher level to a lower; for example, to fill or empty lock chambers, or to draw off a canal level, mill race, or reservoir of any kind.

This is effected by an ingenious application of hydrostatic pressure. In the effluent sluice is placed a gate, or wicket, with two leaves at right angles to each other, having a cross-section like the letter L, one leaf being longer than the other. This gate works upon pivots, or a hinge, at the angle of intersection of the two leaves, and at one side of the sluice. The shorter leaf of the gate is of proper dimensions to close the sluice when the flow of water is not required. This leaf is kept shut by the pressure of the head of water, which produces no effect upon the longer leaf so long as it is admitted freely to both sides of it.

When the sluice is to be opened, the water is drawn from one side of the longer leaf, and immediately the pressure upon the other side preponderates against the shorter leaf, and forces it open.

The opposite effect is produced by admitting the water to both sides of the longer leaf, when the pressure upon the shorter leaf again closes the sluice.

These alternate effects are produced by two small turning wickets at right angles to each other and coupled together, which are moved simultaneously by a single lever.

For the details, the committee refer to the annexed description and drawing, without which, they would be unintelligible.

In the model and plans, the small wickets are on a scale representing fifteen inches square, and the sluice is three feet wide and five feet high, having an opening of fifteen square feet. The time and effort required to manœuvre the small wickets will certainly not be greater than is necessary to work one of the simple turning wickets generally used in lock gates, while the quantity of water discharged by the sluice will, with the above proportions, be about four-fold, and may, by a variation of the relative dimensions of the parts, be greatly increased.

In conclusion, the committee will observe, that, in some important particulars, the apparatus under consideration resembles the very ingenious device invented by Josiah White, Esq., and known as the "Bear-trap Sluice." It is probable, indeed, that the original idea was suggested by that contrivance, with which the Institute is familiar.

In the application of the same general principle, however, and in the details, as well as the uses to which "F. C. Lowthorp's wicket-gate" is applicable, the committee recognize originality and ingenuity worthy of praise, and they commend the invention, to those having important hydraulic works to construct, as deserving of their attention and investigation.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, March 11, 1847.

Description of F. C. Lowthorp's Wicket-gate for Canal Locks.

Fig. 1 is a plan, in which the part A, is intended to represent a reservoir, lock-chamber, &c. *a*, *d*, shows the leaves of the "wicket-gate," (which is supposed to be placed in the side wall of a lock,) both of which are secured to the shaft, *s*, and are connected by means of the rods, or bars, *p*, *p*. H, is a recess, or chamber, into which the leaf, *d*, moves in opening the leaf, (or gate,) *a*. *i*, *o*, are small valve-gates, (so connected, or coupled, *that both may be turned at the same time*, the one opening, and the other shutting,) used for emptying and filling the chamber, H, and may be worked as shewn in the plan and sectional views, (see figs. 1, 2, and 3,) or otherwise. *c*, *c*, is a channel, or pipe, communicating with the water in the (lock-chamber, or) reservoir, A, and the chamber, H, through the valve-gate, *i*. *g*, is a grating intended to prevent the channel, *c*, *c*, from becoming obstruct-

ed. *n*, *n*, is a channel, or pipe, communicating with the chamber, H, and the lower level, through the valve-gate, *o*. *m*, is a man-hole in

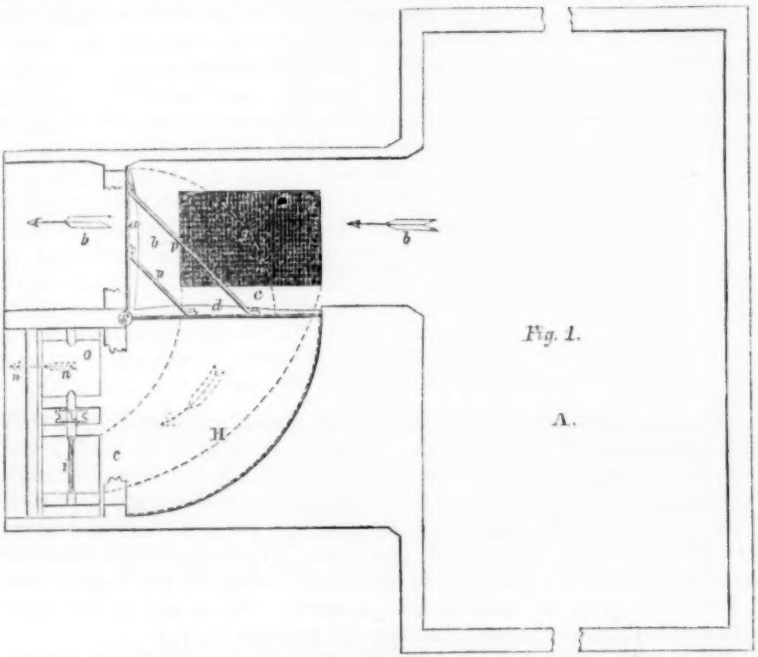
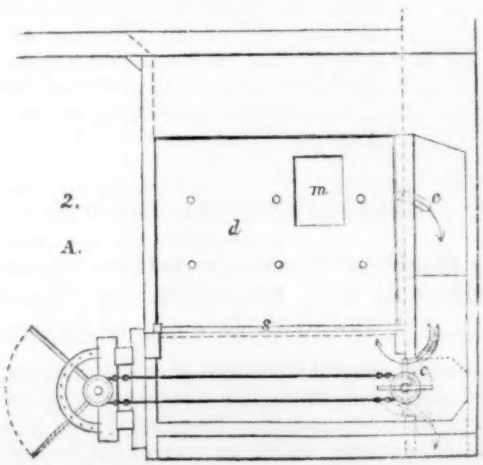


Fig. 1.

A.

the leaf, *d*, for the purpose of getting at the small valve-gates *i*, *o*, for repairs and other purposes. *b*, *b*, *b*, shows the water-way communicating with the reservoir and the level below.

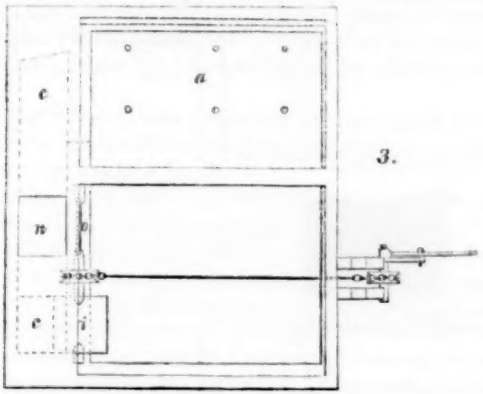
Fig. 2 is a longitudinal section of the plan, or fig. 1.



2.

A.

Fig. 3 is a cross section of the same.



3.

The plan represents the wicket-gate as closed, and the lock, as well as the chamber, H, full of water. When it is desired to empty the *lock*, the valve-gate, *o*, communicating with the lower level through the channel, *n*, *n*, is opened; at the same time, the valve-gate, *i*, (which is connected with the same,) communicating with the lock-chamber, through the pipe, *c*, *c*, is closed; the water is thus discharged from the chamber, H, and the pressure of the water acting on the larger leaf, *d*, forces the (gate, or) smaller leaf, *a*, open. The water in the lock-chamber is then discharged through the passage, *b*, *b*, *b*.

The inventor does not propose to confine himself to the precise mode of construction shown in the plan, but purposes availing himself of different modes of construction to suit different localities where gates for discharging water are used; the principle remaining the same, which consists in alternately applying and relieving the pressure from one side of the larger leaf (arm, or paddle) of a wicket-gate, thereby causing it to turn one way or the other, so as to force the other leaf of the gate open or shut, as may be desired; both leaves of the (valve-gate, or) wicket-gate being secured to, and made to turn on, or with, the same shaft, or axis; the shaft being placed in a vertical, horizontal, or in any other position desired.

BIBLIOGRAPHICAL NOTICE.

The Literary World: A Gazette for Authors, Readers, and Publishers. Edited by E. A. Duyckinck, Esq., *and Published by* Osgood & Co., 136 *Nassau Street, corner of Beekman, N. Y.*

We have received several numbers of "The Literary World," a new periodical published weekly, in quarto form, in the city of New York, at three dollars per annum. Its general plan is similar to that of the London Athenæum, which we have long looked upon as one of the most interesting and valuable of our exchanges. The tone of

the criticisms contained in this new candidate for public favor is good, its reviews of new books are marked by good sense and good taste, and it has our best wishes for its success.

The vast increase of our population, combined with its restless activity, and the extension of the intercourse of all parts of our country with each other and with foreign countries, call for corresponding efforts on the part of our citizens to sustain such of their own periodicals as are conducted so as to be worthy of permanent support. The great difficulty of sustaining, for a series of years, a scientific or literary journal in our country, is well known to those who have made the attempt; and yet the Americans are emphatically a reading people, and ever anxious to extend their knowledge of what is going on in the world. One cause of this difficulty is excess of competition, which divides and subdivides both the efforts of those by whom such works are conducted, and the patronage of the public, by which they must be maintained. No sooner has a scientific or literary journal struggled into a position which promises a continued existence and the possession of a field of usefulness of respectable extent, than a rival starts up to contend with it for a part of that patronage, which is barely enough for one, and altogether insufficient for two. The result too often is that both fail. The right remedy is an extension of public favor to those American journals which have maintained, for years, a high character, or to those newly established which are original in their aims, or conducted with marked ability.

MECHANICS, PHYSICS, AND CHEMISTRY.

Extract of a letter from PHILOS B. TYLER *to the Actuary of the Franklin Institute.*

SIR,—I have always wondered, when reading the advertisement of your Committee on Publications, that more observations of practical men were not communicated for publication; but I suppose they have, like myself, feared that matters which appeared interesting and important to themselves, might be common-place and uninteresting to others. I have a great desire to be useful in my sphere, which, together with my interest in the Institute, has induced me to communicate the enclosed observations to your Committee, begging that they will use them in any manner which they think proper, my only object being to communicate information.

Respectfully and truly yours,

New Orleans, Feb. 22, 1847. P. B. TYLER.

TO THE COMMITTEE ON PUBLICATIONS OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Gentlemen,—From the great satisfaction which I have found in seeing and hearing of improvements in tools for mechanical operations, I have thought that a description of some of those which have appeared interesting and novel to me, might be acceptable to many of the readers of your valuable journal. A description of one or two of

them will give you an idea of the class of improvements to which I refer.

Centre Punch.—It is customary, in moving the "centres" of a piece of iron intended to be turned, to drive a centre punch into the holes previously made; first, at an angle, in order to force the metal over to the side required, and then, to drive it in, perpendicularly, in order to give the hole the proper shape for the lathe centres. This is frequently repeated, until the hole is mutilated, or driven so deep as to be objectionable, and is absolutely ***barbarous*** on a nice piece of work. There are other modes of moving the centres of accurate work, such as the scraper and centreing drill, but this is the mode generally adopted on account of convenience, and for that reason has done injury to much fine machinery.

The new plan adopted for this purpose, which I saw in a small shop in Massachusetts, appears to me to be equally convenient with

the ordinary centre-punch, while it is quite as perfect and unobjectionable as any of the more tedious modes. This tool is formed by making the conical point of a centre-punch on an angle with its shaft. It will be readily seen that by using this punch, the hole will be more easily moved laterally, that its uniform conical shape will be preserved perpendicular, and that the distance of moving it may be accurately managed by the blow of the hammer upon the punch.

Mode of Skimming Ladles for Pouring Cast Iron.—I saw, in a foundry in Connecticut, a mode of skimming small ladles for pouring cast iron, which was found to be very useful, and as I have not seen it in any other place, I presume it is new. It consisted in riveting a small bar of iron across the top of the ladle, just back of the mouth, and covering it with clay, the same as the bottom of the ladle, to prevent its cooling the melted iron. The bar should extend far enough below the top of the ladle to commence skimming from the first, and near enough to the mouth to continue until all is poured. I saw some ten or fifteen persons pouring with these ladles, while not one was required to skim, and I was told that no objection was found to it in any respect.

Respectfully yours,

New Orleans, Feb. 22, 1857. PHILOS B. TYLER.

On the Corrosion of Metals. A Paper by R. ADIE *of Liverpool, read at the Institution of Civil Engineers.*

This communication is intended to give an experimental proof of the fact, that water saturated with common salt, preserves to a great extent, the surface of the oxidizable metals from corrosion by the joint action of air and water. From some trials upon metals placed beside water in closed glass tubes, it was shown that water, or water containing a saline solution, does not act as a corroding agent, without the aid of the oxygen of our atmosphere. The details of some experiments, made to ascertain the quantity of oxygen dissolved by water under different circumstances, showed that brine and some other saline

solutions contain much less dissolved oxygen than sea or ordinary water, which was the fact that induced the trial of salt water as a preserver of iron. The object of the last set of experiments was to determine by trial, the rates of corrosion of metals in fresh water, sea water, and brine; the results of these show that sea water corrodes the quickest, fresh water less rapidly, and brine very much slower than either.

On the rate of action of brine, sea and fresh water in corroding.

These experiments were made with weighed pieces of metal immersed in the three solutions under examination. Those which are compared together, were tried in every respect under similar circumstances, as to weight and surface of metal; size and form of vessel; quantity of water employed; light and temperature.

The experiments on zinc were made with that metal in connexion with a piece of copper, so as to form a galvanic couple; for zinc, when unconnected with a less oxidizable metal, is soon covered with a crust of oxide, so that pieces, after a month's immersion in water, are found to be slightly heavier than at the beginning of the experiment. This is not the case when a piece of silver or copper is in metallic connexion with zinc; for then the white oxide of the metal is gradually precipitated to the bottom of the containing vessel.

A plate of zinc, 1 superficial inch in area, immersed for 60 days in sea water, -	lost 1·6 grains.
A similar experiment in fresh water	" 1·15
A plate of zinc, 7 superficial inches in area, immersed for 96 days in fresh water,	" 4·9
A similar experiment in brine, or the saturated solution of common salt, tested as above for dissolved air, - -	" 1·4
Wrought iron wire :—	
Twenty pieces of iron, weighing 374 grains, immersed for 80 days in fresh water,	lost 1·9 grains.
A similar experiment in sea water -	" 2·6
A similar experiment in brine -	" 0·1
Cast iron :—	
Three rods of cast iron, weighing 787 grains, immersed for 62 days in fresh water, -	lost 1·6 grains.
A similar experiment in sea water -	" 2·0
A similar experiment in brine -	" 0·4

On comparing together the loss of weight of metal in the fresh water, sea water, and brine, it will be observed, that in sea water the corrosion is about one-third more than in fresh water; while in brine, the loss of weight is about one-fourth part of the loss in fresh water, and one-fifth part of that experienced in sea water; showing that brine possesses considerable power for preserving metals from corrosion. The carbonates of potash and soda are still more effectual in arresting oxidation; for in saturated solutions of these salts, iron wire remained immersed for 60 days without any amount of corrosion being detected. The surface of the plate of zinc, when taken from the brine, was the same as at the commencement of the experiment, ex-

cepting in three spots, where there was deep corrosion. The principal of these being around the point, where the copper wire connected the plate with the negative element. The difference shown between fresh water and sea water, in their power of oxidizing metals, is in the reverse order of the quantities of oxygen dissolved by them, as given in the preceding experiments; where the sea water is to the fresh as 78 to 85. The principle on which the preserving power of alcohol is attempted to be explained may, in like manner, be here applied to pure water. Although the experiments on the corrosion of iron were continued for eighty days, the difference between the action of common water and brine may be made apparent in one day. In the fresh water, the hydrated peroxide of iron is seen forming; while, in the brine, only a slight tinge of a greenish infusion can be detected, a sure indication of the scarcity of oxygen.

The experiments given to determine the respective rates of corrosion in fresh and sea water, are only correct for pieces of metal wholly immersed in them. Where the surfaces are subject to be wet and dry, the corrosive effect of sea water will greatly increase; on the same principle that iron once coated with rust, decays much faster after the rust has provided a lodgment for moisture. Take for example a bar of iron in a field, and a similar piece on the deck of a ship. On the first, the dew of night deposits water, which corrodes until the return of the sun dries it all off. On the second, on the deck, it deposits spray, which acts like the dew, until the sun dries it off; but when dried, there is left a thin deposit of salt, with a powerful affinity for moisture, which on the return of evening will attract moisture from the atmosphere, long before the dew wets the metal in the field. Thus it is that a coating of salt or rust, keeps metals much longer in a wet state, than if their surfaces were clean.

Remarks.—The experiments which showed that brine [by which term, he supposed, a saturated solution of common salt in water was meant] should be found to be less corrosive of iron than sea water, were consistent with the circumstance, that less air was contained in water which was saturated with any solid substance, than was contained in water only slightly impregnated with such substance, and there was no doubt, but that the atmospheric air performed a principal part in the oxidation of iron, which was exposed to the weather. Air containing water in solution, corroded iron rapidly; and water containing air in solution, did the same; and alternate exposure of iron to water and to air, corroded it still more rapidly: particularly when by the warmth of the sun, and the blowing of the wind, the film of water which was left on the surface of the wetted iron was evaporated, or dried away from that surface, before a fresh wetting occurred. Perfectly dry air was very slightly, if at all, corrosive of iron, and water completely freed from air by boiling, was not actively corrosive in the manner that air and water were. Respecting salt, there was nothing corrosive of iron in its own nature; it contained no oxygen, but although it was a great cause of corrosion of iron, the corroded iron was found to be an oxide, not a muriate of iron. The salt when dissolved in water, greatly increased the corroding effect upon iron

which was immersed in the salt water, and still more if the iron was frequently wetted, or washed with salt water, and dried by the sun and the wind, in the intervals between successive wettings. The concurrent effect of air, water, and salt, was extremely corrosive of iron. It was well known, that dry salt was not at all corrosive of iron, for, in stoves for drying salt, the flues were frequently made of iron plates, and the salt in lumps being laid directly upon the iron, did not corrode it at all, the iron being always kept hot and dry; in the same stoves, if they were not used, and allowed to cool, the salt absorbed humidity from the air, and became very corrosive of the iron work. Iron salt-pans, for boiling brine, did not become oxidated as rapidly as might be expected: indeed, they were scarcely affected at the parts of the upright sides of the interior surface of the pans, which were always beneath the surface of the hot brine and were not exposed to the action of fire. The manner in which salt operated, to increase the oxidation of iron, was probably by an electro-chemical action, the chief part of the oxygen which the iron absorbed, being derived from the atmospheric air, the other part from the water, and none from the salt. In heaps of old iron exposed to water, it might be observed to lodge in the hollows, and to occasion rapid rusting of the iron, attended by a smell of hydrogen, and a thin pellicle floating on the surface of the water, showing dingy prismatic colors. The paper which had been read, mentioned absorption of oxygen from the air by water; it was generally understood, that, when water absorbed air from the atmosphere, the nitrogen of the air, as well as the oxygen, were both absorbed together by the water, in their accustomed proportions, as they existed in the atmosphere, so as to be an absorption of atmospheric air by the water.

Mr. Lowe said, the paper led to the consideration of the change which was induced in cast iron, by continued immersion in various fluids. This had been frequently discussed at the Institution, and it would be desirable if Mr. Adie would continue his experiments, with a view to elucidating that question, as the conversion of cast-iron into carburet of iron, or graphite, appeared, under certain circumstances, to be so rapid, as to have rendered necessary the substitution of other and more expensive metals. In breweries, for instance, the change had been produced so very speedily, wherever the acid wash came in contact with metal, that copper gratings had been of necessity substituted for cast iron.

Sir John Rennie, President, stated, that the earliest example in his recollection of the change produced by sea water in cast iron, was in some iron guns which were fished up in 1822, off Holyhead. They were supposed to have belonged to a pirate vessel which was destroyed there about 100 years previously. When found they were quite soft, but after exposure to the air for a time, they became so hard, that they were used to fire salutes, when George the IVth passed through Holyhead, on his way to Dublin, and it was remarked that the report from them was louder than from any other iron guns of a similar size. Civ. Eng. & Arch. Jour.

Description of the Iron Dock-gates, constructed by Messrs. Rennie, for the Russian Government, and erected at Sevastopol, on the Black Sea. By Mr. Shears, Assoc. Inst.

Sevastopol is peculiarly situated, amidst rocky ground rising so abruptly from the shore that there was not space for the buildings necessary for a dockyard. On account of the depth of water close in shore, and other natural advantages, the Emperor determined to make it the site of an extensive establishment; and as there is not any rise of tide in the Black Sea, and the construction of coffer-dams would have been very expensive and difficult in such a rocky position, it was decided to build three locks, each having a rise of 10 feet; and at this level of thirty feet above the sea to place a main dock with lateral docks, into which vessels of war could be introduced, and the gates being closed, the water could be discharged by subterranean conduits to the sea, and the vessel being left dry, could be examined and repaired even beneath the keel. A stream was conducted from a distance of twelve miles to supply the locks, and to keep the dock full. This, however, has been found insufficient, and a pumping engine has since been erected by Messrs. Maudslay and Field for assisting. The original intention was, to have made the gates for the docks of timber; but on account of the ravages of a worm, which it appears does not, as in the case of the Teredo Navalis, or the Terebranes, confine itself to the salt water; it was resolved to make them with cast iron frames covered with wrought iron plates. There are nine pair of gates, whose openings vary from 64 ft. in width and 34 ft. 4 in. in height for ships of 1200 tons, to 45 ft. 7 in. in width and 21 ft. in height for frigates. The manipulation of such masses of metal as composed these gates demanded peculiar machines. Accordingly, Messrs. Rennie fitted up a building expressly with machines constructed by Mr. Whitworth; by which all the bearing surfaces could be planed, and the holes bored in the ribs and all the other parts, whether their surfaces were curved or plane. The planing was effected by tools which traveled over the surfaces backwards and forwards, cutting each way; the piece of metal being either held in blocks, if the surface was plane, or turned on centres, if the surface was curved. The drilling was performed by machines so fixed that the pieces could be brought beneath or against the drills in the required direction, and guided so as to insure perfect uniformity and accordance between them. Traveling cranes were so arranged as to take the largest pieces from the wharf, and place them in the various machines, by the agency of a very few men, notwithstanding their formidable dimensions;—the heelposts, in some cases, being upwards of 34 feet long. Each endless screw, for giving progressive motion to the cutting tools, was 45 feet long. Some idea may be formed of the manual labor avoided by the machines, when it is stated that the surface planed or turned in the nine pairs of gates, equals 717,464 square inches, and in some cases, a thickness of three-quarters of an inch was cut off. The surface in the drilled bolt-holes equals 120,000 square

inches. The paper gave all the details of the construction of the gates and the machinery for making them,—and was illustrated by a series of detailed drawings. A discussion followed; chiefly on the peculiarity of the site selected for the docks,—and the supposed ravages of the worm in fresh water, as it was of unusual occurrence. It seemed to be the opinion that temperature of climate influenced the ravages of these insects.—*Transac. Inst. Civ. Eng.* Athenæum.

Observations on the Phenomena of Terrestrial Refraction.

I have been induced to make the following remarks, from the perusal of a paper on this subject, by Dr. W. Kelly, R. N., and which appeared in the August number of the *Nautical Magazine* for the last year.

The result of the Doctor's observations seems to me to accord so well with the established theory of refraction, depending upon the transmission of the visual rays, through mediums of varying densities, that it may perhaps be interesting to some of your readers to trace the connexion which I have attempted to establish in this paper.

When the superincumbent air is in a state of comparative equilibrium, and the vapor contained in it is impartially distributed, I apprehend that no perceptible distortion of image will take place. The air may be denser or more rarefied according to its temperature, and the moisture may be in excess or defect of its mean quantity, so as to increase or diminish the refraction; but so long as these conditions were equally diffused over that portion under examination, there would be no apparent distortion, and, indeed, the observer, without the aid of an instrument, could scarcely detect the presence of any unusual cause of variation. Immediately, however, this state of equilibrium, or equal diffusion of the refracting medium, is destroyed, the visual rays, instead of describing nearly uniform curves, will be deflected variously, according to the condition of the mediums through which they are transmitted.

By reason of the highly elastic nature of the atmosphere, no very partial effects from varying causes, could, I imagine, be maintained: and therefore, it seems to me, that the principal causes of unusual refraction arise from the changes produced in the *aqueous* portion of the atmosphere, by alterations of temperature; and these changes will be more or less remarkable, according to the quantity of moisture present. Where the air is saturated with moisture, it will require but a small change of temperature to produce a perceptible effect on the refraction, compared with what would be required when the air was dry.

Let us now see what would be the effect assigned by theory to that condition, in which the surface water was *colder* than the incumbent air. The moisture in the latter would be condensed, and from its increased gravity would descend and augment the refracting power of the medium, so that rays transmitted through it, from any distant object, would reach the eye under a greater angle of elevation. The

moisture so affected, frequently rests upon the land or water in a strongly defined stratum; and when its height is less than the object seen through it, distortion will be very evident, and sometimes very curious. In the North Sea, during this state of the atmosphere, I observed the luff of the jib of a fishing smack, about two miles distant, to be bent and assume the shape of a jib-topsail.

A distant ship, seen at the same time, was affected in the following manner:—The hull appeared of its proper form and size, perhaps somewhat larger, and the courses were not so much contracted in height as the top-sails, whilst the top-gallant sails retained their usual appearance. Now, that part of the stratum of vapor which was near the surface of the sea, might, I conceive, be very nearly of the same density; and hence, rays proceeding from objects immersed in this medium, being affected nearly in the same degree, would bring to the eye an image but very little distorted from its real proportions, although the *direction* would be erroneous. The courses would be influenced much in the same manner, but with less uniformity; for, being in the higher and more rarefied part of the medium, they would be less refracted in their upper parts than in their lower, and a slight contraction would therefore be evident; but, in the case of the top-sails, whose upper portions were *above* the influence of the extraordinary refraction, the rays proceeding therefrom would reach the eye under the usual angle of elevation, whilst the lower parts, being *within* the medium of extraordinary refraction, would be elevated above their true position, and hence give to these sails a very sensibly *contracted* appearance. The top-gallant sails, being entirely above the defined stratum of vapor, would appear of their ordinary shape.

These phenomena were, in my opinion, concomitants of that condition of the air and water, in which the temperature of the latter was lower than that of the former.

When the surface water is *warmer* than the incumbent air, a contrary effect will generally be produced, and more particularly when the air is unusually dry. Under these circumstances, there is no tendency to *stagnation*, as in the former case, where the moisture descends and hangs on the surface in fogs or dense vapors, thereby increasing the refractive power; but the evaporation from the water being regulated by the demand in the air, is continually carried upward *(not accumulated)* until it meets with an arresting atmosphere, and is condensed in vapor and cloud. Calms are, therefore, more particularly favorable to the production of the mirage with elevated horizon; for a breeze, by disturbing and dispersing the stagnated medium, will, in most cases, destroy the phenomenon.

A variety of circumstances may occur in these partial affections to modify the results of general principles, and it shows us how very difficult it is, even with the help of a dip-sector, to obtain a true correction for refraction; for where these mirages are of frequent occurrence, as in the Polar Seas, and Gulf of St. Lawrence, owing to the presence of currents of unequal temperature, how often may the opposite portions of the horizon be under the influence of unequal intensities. From these variations of density in the different parts of

the superincumbent air, it is almost impossible that the amount of terrestrial refraction will be the same at different times, for different places. The visual rays, instead of describing regular curves, may be deflected in a *zigzag* line; and this circumstance will sufficiently account for the wide difference in the values assigned by the several observers to the effects of terrestrial refraction.

For the same reason, the indications of the thermometer and hygrometer will be, in general, too partial to account for phenomena produced at a distance.

The occurrence of mirage during strong, or even fresh, winds, can be, I imagine, but seldom, particularly of that kind with elevated horizon; nevertheless, the atmosphere, by being charged with an unusual quantity of moisture over a wide space, might continue for some time to produce mirage of the latter description, even in the presence of a strong breeze; while those with the depressed horizon might more readily exist whenever the air was unusually dry.

As the temperature of the sea is not changed by solar influence nearly in the same degree as that of the air, this circumstance, considered by itself, would be most favorable for the formation of mirage with *elevated* horizon, when the latter had attained its maximum temperature, or at some time in the afternoon; whereas, that of the former kind would, from the same circumstances, occur more frequently in the morning. Again, as evaporation is usually more active during the heat of the day, it would operate against that *stagnation* which I have considered favorable to the production of mirage with an *elevated* horizon; but as the air became cooler, this activity would be checked, and a condensation of moisture near the surface of the sea, and increased refraction would probably take place. So that two circumstances combined would seem to point out the latter part of the solar day, as the time when this kind of mirage will be most frequent. The light winds, which often succeed to the fresher breezes of the day, may also have their influence.

While employed in the North Sea survey, I had frequent opportunities of observing the curious and important effects produced in the atmosphere by the various causes above mentioned. Our operations when out of sight of land, depended very much on the horizon and the subtending angle of the Tender's mast, which are both materially affected by the changes in the state of the atmosphere near the sea. I have known the latitude of the same position to differ 2½ miles by meridian observations on two consecutive days; and the longitude would necessarily share in the error of the latitude as well as in the originating cause. The use of the dip-sector, and the method of observing the altitude, north and south, should therefore be resorted to; for, although, (as I have before remarked,) even these might give erroneous results, they would materially serve to decide our judgment as to the value of these observations.

The subtending angles were, from the same causes, very materially and frequently affected, and the distances deduced therefrom incorrect. In the case of an elevated horizon, the lower part of the vessel being more refracted than the upper, the observed angle is therefore

smaller, and the assigned distance proportionally greater, than the truth; and this error increases as the object is nearer to the horizon. Hence the propriety of great caution in using this mode of obtaining distances; and the preferable method of a base found by two objects, especially in establishing the several positions of the stationary vessel.

At present, I despair of seeing these fluctuating causes and effects brought under the subjection of any law that could enable us to assign its true amount, and to correct those observations which come under their influence.

G. A. Bedford, *Commander, R. N.*

Lond. Naut. Mag.

On Gun Cotton. By Professor Brande.

This communication related: 1st. The history of compounds produced by nitric acid with certain organic substances. 2nd. The preparation and properties of Schönbein's gun-cotton. 3rd. The practical uses of the invention.—1st. With respect to the philosophical history of the discovery. Between fifteen and sixteen years ago, Braconnot ascertained that starch, wood-shavings, saw-dust, linen and cotton fabrics, when treated with concentrated nitric acid, produced a sort of gelatinous substance, which coagulated into a white mass on the addition of water. Braconnot called this substance *xyloidine*, from its resemblance, in some respects, to ligneous matter. Xyloidine is, as Professor Brande demonstrated by experiment, highly inflammable. Two years after Braconnot's investigations, Pelouze published some inquiries into the nature and properties of xyloidine. He ascertained that starch, when converted into this substance, exchanged an atom of its constituent water for an atom of nitric acid. He also observed that it took fire at a temperature of about 360°. This facility of combustion, and the fact of its burning without leaving residue, induced Pelouze to cover paper and other textures with a film of xyloidine by plunging these substances into dilute nitric acid. When thus prepared, they resemble parchment in appearance, are very inflammable, and impervious to moisture. Pelouze suggested the use of paper treated in this manner for the purpose of artillery. Such was the state of science on this subject when, in the course of last year, Professor Schönbein examined the effect produced by a mixture of sulphuric and nitric acids on organic bodies. One purpose of his research was to ascertain the qualities of a form of matter which he calls *ozone*. On this subject we cannot digress further than by presenting the following equation, which will convey Schönbein's views to our chemical readers:—

$NO^5\ HO + SO^3\ HO = NO^4\ SO^2 + 2HO^2$. ($HO^2$, the symbol of the oxy-water of Thenard, being also that of Schönbein's ozone). It was in the course of these researches that Schönbein found that each of those singularly allied bodies, sugar, starch, gum, and woody fibre, assumed its own peculiar state when brought under the influence of

the mixed acids; and that woody fibre in the form of tow, cotton-wool, &c., when plunged into a mixture of these acids, becomes a highly explosive compound. The substance thus prepared was exhibited, on Professor Schönbein's behalf, by Mr. Grove, on the 15th of September last, to the British Association, and (as Professor Brande pointedly observed) it was not till that time that the supposed claims of others to any share in this discovery were advanced.—Professor Brande proceeded, 2ndly, to describe the preparation and properties of the gun-cotton. Having been first cleansed and carded, cotton, according to Schönbein's process, is immersed for a short time in a mixture of two parts (by measure) of sulphuric with one of nitric acid. It is then taken out, well washed with water, and carefully dried. The cotton is then found to have acquired the following properties:—Though identical with common cotton (even under the microscope) in ordinary light, it appears dark when viewed through a magnifier in polarized light. It may be repeatedly moistened with water and dried without losing its acquired properties. It is an insulator of electricity, being powerfully *negatively electric*. It is singularly hygrometric. It catches fire at a temperature of about 360°, and burns with far greater rapidity than gunpowder; and yet the combustion of a train of this cotton can be stopped in its course by strong pressure—an important circumstance as bearing on its application. The products of its combustion are carbonic and nitric oxides, carbonic and oxalic acids, cyanogen, nitrogen, and steam.—3rdly, In respect to the uses of gun-cotton, Professor Brande remarked that it was more energetic than gunpower. From experiments made at the mills of Messrs Hall & Co., the patentees, it would appear that about one half ounce of gun-cotton carried a 68 lb. shot 255 feet from an 8-inch mortar; while 2 ounces of gunpowder carried a shot of the same weight, from the same gun, only 152 feet. The average of four fires from a tiger-rifle, No. 14 gauge, charged with from 60 to 80 grains of gunpowder, carried a ball through three *inch elm boards* packed closely together; while 30 grains of gun-cotton carried a ball, under the same circumstances, through *six such boards*. Adverting, in conclusion, to the alleged disadvantages and advantages of Schönbein's invention, Professor Brande remarked of the former that it was hardly just to ascribe them to what was so recently known, and, therefore, so imperfectly examined, as an article of commerce. The use of gun-cotton in fire-arms has been said to be attended with the following disadvantages:—That the effects are less regular than those of gunpowder.—That it is more dangerous, because inflaming at a lower temperature.—That it does not take fire when compressed in tubes.—That it burns slowly in all kinds of cartridges.—That guns and pistols must be altered to admit of its use.—That it is not adapted for the use of the army.—That the barrel of the gun is moistened by the water produced during combustion. The advantages, on the other hand, may be stated as follows:—Its extreme cleanliness, leaving no residue after combustion.—Its freedom from all bad smell.—The facility and safety of its preparation.—The possessing treble the force of gunpowder.—Its explosion producing no smoke and less noise than

that of gunpowder.—Its filamentary nature admitting of its being used overhead in mining operations.—Its not being liable (as a granulated substance is) to the accidents of leakage.—Its occasioning very little recoil.—*Trans. Royal Inst.* Athenæum.

On Gunpowder. By Prof. Faraday.

Prof. Faraday briefly noticed the known composition of gunpowder as consisting of—75 parts of nitre, 15 parts of charcoal, 10 parts of sulphur; which, converted into equivalents, give—1 of potassium, 1 of nitrogen, 6 of oxygen, 3·4 of carbon, 0 85 of sulphur, in a state of mechanical mixture. He then proceeded to advert, 1stly, to the *manner of the action of gunpowder.* Gunpowder was described as a solid body, in which a source of enormous power was locked up, capable of being brought into immediate operation whenever wanted: the action thus elicited being itself regulated by human skill with wonderful precision. The respective functions of the sulphur, nitre, and charcoal, in producing the effects of gunpowder, were experimentally shown. The enormous quantity of gas generated by the combustion of gunpowder, irrespective of heat, was exhibited. It was remarked that, on the ignition of gunpowder, though the sulphur begins the combustion, it is not itself burned by the oxygen of the nitre, but unites chiefly with the potassium of that salt to form sulphuret of potassium,—a substance which assists in giving to the flame of gunpowder an intense heat. 2ndly. The *amount of heat required for the inflammation of gunpowder* was next adverted to. If gunpowder and steel filings be dropped together through four or five inches of flame, the latter will burn, though the former will not. A flame from gas was made to play for several seconds on a heap of gunpowder, without lighting it; but, 3rdly, *when actually lighted, gunpowder evolves very great heat.* It is to the immense heat produced on the solid products of the combustion of gunpowder, that the certainty of its complete combustion is greatly owing. In this respect gunpowder differs characteristically from gun-cotton. The latter fires at a heat which would not affect the former; but produces, by its combustion, a degree and condition of heat much less communicable to other bodies. 4thly. The *effect of the heat generated, independent of the chemical change from the solid to the gaseous or vaporous state,* namely, that due to mere expansion or increased elasticity producing the effects of gunpowder, was adverted to. This was illustrated by the violence with which a mixture of one volume of oxygen with two of hydrogen gas bursts the vessel which contains it, solely in consequence of the heat elicited during their combination. This is manifest from the fact that the space occupied by the uncombined gases, is greater by one-half than that taken by the resulting steam. 5thly. Prof. Faraday laid great stress on the *effect of the granulation of gunpowder.* To this condition of gunpowder, presenting, as it does, a number of separated surfaces of size just sufficient to become surrounded with flame at the same instant of ignition, much of the disruptive or projectile effect of gupowder was ascribed. It was shown

that, without that porosity which its division into grains imparts to a mass of gunpowder, the explosion of the whole could not be instant nor simultaneous. This was proved by bringing a piece of mill-cake successively into the condition of grain powder and of meal powder. The slow combustion of the solid meal powder fuse was compared with the quicker inflammation of the hollow rocket, and the instant inflammation of the charge of a gun. All these effects are related to the condition of the interior of the gunpowder in respect of its permeability by the flame of the first particles ignited. Then, as to its exterior condition, it was shown that the tardy burning of the miner's fuse is due to the granular state of the powder in its case being counteracted by the pressure of the strands of rope wrapped very tightly round it; while, on the other hand, in the cracker of the firework-maker, a similar train is instantly fired throughout, because it has a loose jacket all over it, and, in the burning of the common cracker, an alternation of these effects is produced. In conclusion, Prof. Faraday dwelt on the great importance of *time* in producing the effects of gunpowder. Contrasting the action of gunpowder with that of fulminating mercury and silver, or of those still more fearfully explosive compounds, the chlorides of nitrogen and of iodine, Prof. Faraday showed that, if the explosion of gunpowder were really instantaneous, it would be useless for all its present applications. As it is, however, whenever gunpowder is fired in the chamber of a gun, it does not arrive at the full intensity of its action until the space it occupies has been enlarged by that through which the ball has been propelled during the first moment of ignition. Its expansive force is thus brought down and kept below that which the breach of the gun can bear, whilst an accumulating, safe, and efficient momentum is communicated to the ball, producing the precise effects of gunnery. This manageable action was contrasted with the effect of a morsel of iodide of nitrogen put on a plate, and exploded by being touched by the extremity of a long stick. The parts immediately in contact with the iodide were shattered,—*i. e.*, the end of the stick was shivered, and the spot in the plate covered by that substance, was drilled as if a bullet were fired through it, yet no tendency to lift the stick was felt by the hand, —whereas the comparatively gradual action of gunpowder lifts and projects those weaker substances, wadding and shot, which give way before it. Ibid.

Recent Discoveries and Improvements in the Arts in Europe.

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Extracts from a letter of M. JOBARD, *Director of the Belgian Musee de l'Industrie to* DR. QUESNEVILLE, *Editor of the Revue Scientifique et Industrielle.*

After briefly describing the cotton powder of Prof. Schönbein, he proceeds:—

Malleable Glass.—"The same chemist has discovered what may, to a certain extent, be called ***malleable glass.*** He renders the pulp of common paper transparent, by causing it to undergo a certain trans-

formation, which he calls *catalytic*, for want of an intelligible term. With this paper, made water-proof, he manufactures perfectly transparent window-panes, vases, and bottles, which may be let fall without breaking."

Important Discoveries made and lost.

Grape Sugar.—"As there are persons who having made a fortune cannot keep it, so there are experimenters who have made important discoveries and have lost them. For instance,—Prof. Meynier, of Marseilles, one day crystalized perfectly *glucose*, (grape sugar,) and since that time he has sought in vain the conditions under which the crystals were produced."

Metallic Cement.—"The same thing happened to the engineer Brey, of Milan, who once hit upon a metallic cement—of which he made a tube, which presents all the characters of cast iron—without being able, since that time, to hit again upon the same proportions. M. Brey believes that he recollects that there entered into the composition, ammonia, sulphur, sifted iron-filings, and another ingredient, which, as well as the proper proportions of the materials, he forgets; but there is his tube, which, under the file and cold chisel, behaves exactly like cast iron."

Apparatus for Measuring the Force of Galvanic Magnets.—"The Italians are, as is known, skilful electricians, the scientific world knows Professor Magrini, of Breyra, who is now preparing a beautiful series of experiments upon electro-magnetism. We ask his pardon for describing the curious apparatus for measuring, experimentally, the force of galvanic magnets, which we saw upon entering his laboratory. It is very simple when it is once invented. To the upper cross-piece of a wooden frame, M. Magrini hangs a dial dynamometer, to which he attaches a horse-shoe magnet, the armature of which terminates in a rack which slides in a beam below. This armature is raised or lowered at will, by means of a pinion or handle. The two wires of the magnet dip into cups of mercury affixed to the sides of the frame, and in communication with the wires of the battery. It is easy to conceive that, being thus able to approach the armature of the magnet more or less, he is able to maintain it at the proper distances to measure all the zones of the attraction of the magnet. Thus he will, without doubt, find the law of decrease of the magnetic influence, upon which philosophers are far from agreeing,—and he will examine the singular assertion of M. Magnee, foreman of the manufactory of arms, at Liege, who asserts that the extent of the influence of permanent magnets is ten times that of temporary magnets exerting the same force at contact. M. Magrini protests against the law laid down by MM. Jacobi and Lenz, that 'when there is no limit either to the mass of the bar, or to the length of the wire wrapped around it, we may, with a current of any force, produce an electro-magnet of any desired power.' M. Magrini has found that, for each element of a Grove battery, a wire of a diameter of $\frac{1}{25}$th inch cannot exceed the length of 200 metres, (217½ yards,) without loss.* M. Cristiforis, Sec-

* This assertion is imperfect; the size of the element should have been given.

retary of the Institute of Milan, asserts that the enveloping wires should not be laid along side of each other, but that they should cross each other at a certain angle, to get the greatest possible coercive power."

Stone Railways.—"But we cannot pass unnoticed the proposition which he is about to make to the Milan Institute, on the subject of a system of stone railways, very practicable in that country with the elastic and tough lava which abounds there. M. Cristiforis proposes to plant solidly in the ground two lines of these stones, as rails, to cut in them two longitudinal grooves, forming the cap of the rail, and to cover this cap with a band of felt, itself enveloped with a band of sheet iron let in the two lateral grooves."

"M. Cristiforis thinks that this rail will not cost more than one and a half francs per metre, (27·5 cents per yard.) which will allow Lombardy to be covered with small roads, worked by horses, and sufficient for a country where iron, wood, and charcoal are rare, and where they do not much care to move quickly,—judging by the slowness with which you go from Milan to Venice."

Magnetical Clock.—"The mechanician of the University of Paria has just finished a meteorological clock, which shews, at the same time, the temperature and pressure of the air, the direction and intensity of the wind, the magnetic variations, and every thing which it is possible to measure and record."

Powerful Electrical Machine—"M. Mousson, Professor, at Zurich, showed us an electrical machine of the ordinary kind, but singularly improved, which, with a single turn, gives a spark of from nine inches to one foot. The whole secret of this improvement consists in the substitution, in place of the two narrow cushions of leather, of two plates of tin, which at least quadruple the rubbing surfaces. Of course the tin plate in contact with the glass rests upon an elastic cushion, fitted in the thickness of the plate. This machine is not in the least influenced by the variations of moisture in the air, which so often destroy the effect of others. The two electricities are here disengaged in such abundance, and the sparks are so long, that it is easy to distinguish, by the eye, the direction of the fluid, and the points from which, and to which, they go. We should add, that the plate of a good machine ought to be of Bohemian glass, which is made with potash. The plates made with the salts of soda, like the French, are worthless for this purpose.

"We recommend them to philosophical instrument makers who desire to have something better than the miserable spark, at most capable of killing a mouse, while these machines, of which we speak, might be advantageously substituted for the guillotine, and satisfy what we call *the justice of man*, without spilling a drop of blood."

Operation of the Prussian Patent Laws.—"Zurich has a technological school admirably conducted by Professor Deschwanden. We cannot speak of an important discovery which he has made, and which he cannot publish without losing the fruit of his labors: for